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REPORT

OF THE

MEDICAL SERVICES, MINISTRY OF HEALTH
SUDAN GOVERNMENT

FOR THE YEAR

1952/53

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REPORT
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CONTENTS.

Chapter — Page

I. Introduction 1

II. Administration.

(*a*) Staff and Functions 2
(*b*) Legislation 4
(*c*) Finance 5

III. Public Health.

(*a*) Health of Officials 5
(*b*) General Health 6
(*c*) Vital Statistics 6
(*d*) Preventive Medicine 7
(1) Insect-Borne Disease 7
(*a*) Malaria 7
(*b*) Blackwater Fever 9
(*c*) Relapsing Fever 9
(*d*) Leishmaniasis 9
(*e*) Trypanosomiasis 10
(*f*) Filariasis 11
(*g*) Onchocerciasis 11
(2) Epidemic and Endemic Diseases 11
(*a*) Anthrax 11
(*b*) Cerebrospinal Meningitis 11
(*c*) Diphtheria 12
(*d*) Dysentery 13
(*e*) Enteric Fever 13
(*f*) Gastro-enteritis of Children 14
(*g*) Leprosy 14
(*h*) Poliomyelitis 14
(*i*) Rabies 14
(*j*) Smallpox 15
(*k*) Tetanus 16
(*l*) Tuberculosis 16
(*m*) Undulant Fever 19

CHAPTER II.

ADMINISTRATION.

(a) STAFF AND FUNCTIONS.

Table I shows the establishment of classified staff. It was not possible to bring the strength of all categories of professional and technical staff up to establishment. The table includes officials who were serving on secondment with local government authorities.

TABLE I

CATEGORY	Establishment		
	British	Sudanese	Others
HEADQUARTERS.			
Director	1	—	—
Deputy Director	1	—	—
Asst. Director (Public Health)	—	1	—
Asst. Director (Hospitals)	—	1	—
Asst. Director (Quarantine)	—	1	—
Inspector of Administration	1	—	—
Establishment Officer	—	1	—
Principal Matron	1	—	—
Controller of Midwives	1	—	—
Chief Public Health Inspector	1	—	—
Principal, School of Hygiene	1	—	—
Labour Officer	—	1	—
Head Staff Clerk	—	1	—
Staff Clerk	—	2	—
Clerks	—	29	—
FINANCE BRANCH.			
Controller of Accounts	—	1	—
Head Accountant	—	1	1
Accountant	—	3	—
Bookkeeper	—	25	—
STORES SECTION.			
Controller of Medical Stores	1	—	—
Superintendent of Stores	—	2	—
Asst. Superintendent of Stores	—	—	1
Stores Supervisor	—	8	—
Storekeeper	—	21	—
HOSPITALS AND DISPENSARIES.			
Senior Physician	1	—	—
Senior Surgeon	—	1	—
Senior Obstetrician and Gynaecologist	1	—	—
Physician	6	2	—
Surgeon	8	1	—
Obstetrician and Gynaecologist	2	3	—
Ophthalmologists	—	2	—
Chest Physician	—	2	—
Psychiatrist	—	1	—
Senior Medical Officer	—	12	—
Medical Inspector	3	14	—
Medical Officer	—	36	26
Medical Officer (hors cadre)	3	—	4
House Officers	—	14	—
Dental Surgeon	2	1	—

Category	Establishment		
	British	Sudanese	Others
Dental Officer	—	—	1
Dental Mechanic	1	2	—
Pharmacists	—	2	—
Dispensers	—	26	—
Controller of Radiography	1	—	—
Asst. Radiographers	—	14	—
Matron	4	—	—
Asst. Matron	11	—	—
Physiotherapist	3	—	—
Nursing Sister	30	—	—
Staff Nurse	—	22	—
Charge Nurse	—	5	—
Nursing Instructor (male)	—	11	—
Nursing Instructor (female)	—	10	—
Theatre Attendant	—	45	—
Bash Momarid	—	40	—
Hospital Superintendent	—	3	—
Laboratory Technician	—	5	—
Province Medical Assistant	—	10	—
Medical Assistant	—	422	—
Clerk	—	56	—
Book-keeper	—	48	—
Stores-Supervisor	—	4	—
Store-keeper	—	16	—
Telephone Operator	—	6	—
	75	836	33
PUBLIC HEALTH.			
Province Medical Officer of Health	3	7	—
Asst. Province Medical Officer of Health	—	5	—
Woman Doctor	6	—	—
Port Health Officer	1	—	—
Principal, Midwives Training School	1	—	—
Asst. Principal, Midwives Training School	—	1	—
Superintendent Midwives Training	—	3	—
Supervisor, Health Visitors	1	—	—
Superintendent Nursing Officer	1	3	—
Staff Midwife	—	2	—
Staff Health Visitor	—	2	—
Health Visitor	—	15	—
Senior Public Health Inspector	4	5	—
Public Health Inspector	—	8	—
Public Health Officer	—	31	—
Sanitary Overseer	—	145	—
Quarantine Overseer	—	1	—
Clerk	—	9	—
	17	237	—
RESEARCH AND LABORATORY SERVICES.			
(*a*) *Stack Medical Research Laboratories.*			
Asst. Director (Research)	—	1	—
Bacteriologist	1	—	—
Pathologist	1	—	—
Registrar	—	1	—
Laboratory Technician	4	—	—
Laboratory Assistant	—	61	—
Head Laboratory Attendant	—	1	—
Clerk	—	3	—

CATEGORY	Establishment		
	British	Sudanese	Others
(*b*) *Medical Entomology.*			
Medical Entomologist	1	—	—
Technical Assistant	—	3	—
Aedes Control Officer	—	1	—
Clerk	—	1	—
(*c*) *Schistosoma Research.*			
Biologist	1	—	—
Senior Technical Assistant	—	1	—
Technical Assistant	—	1	—
Storekeeper	—	1	—
Clerk	—	1	—
(*d*) *Wellcome Chemical Laboratories.*			
Government Analyst	1	—	—
Asst. Government Analyst	1	2	—
Technical Assistant	—	7	—
Clerk	—	1	—
(*e*) *Graphic Museum.*			
Assistant Curator	—	1	—
Museum Attendant	—	2	—
	10	89	—
TOTAL	110	1,260	33

Employees not on the establishment numbered 5,800 approximately.

(b) LEGISLATION.

The following legislation affecting public health was enacted during the year:—

Ordinances.

Date	Short Title	Provision
15.7.1952	Miscellaneous Amendments Ordinance No. 1, 1952.	Includes amendments to Public Health Ordinance, 1939, in conformity with constitutional development.

Regulations and Orders.

Date	Short Title	Provision
15.3.1953	Provisional Order No. 6, 1953.	Amendment to Registration of Births and Deaths Ordinance, 1939.

(c) FINANCE.

TABLE II (A).

Income and Expenditure of Medical Services over the past Four Years.

ITEMS	1949	1950/51	1951/52	1952/53
	£E.	£E.	£E.	£E.
Revenue	42,279	61,845	46,497	49,841
Expenditure :—				
Personnel and Personal Allowances ...	594,508	1,208,239	1,220,105	1,251,664
Services...	414,245	926,374	761,863	908,017
Extraordinary	6,992	35,434	31,805	29,418
TOTAL	1,015,745	2,170,047	2,013,773	2,189,099

TABLE II (B).

Analysis of the Expenditure 1952/53.

SECTION	Personnel	Services	Extra-ordinary	Total
	£E.	£E.	£E.	£E.
Headquarters	85,252	229,563	29,418	344,233
Hospitals and Dispensaries	965,206	586,735	—	1,551,941
Hygiene and Public Health	156,592	87,195	—	243,787
Research	43,668	4,524	—	48,192
Graphic Museum	946	—	—	946
TOTAL	1,251,664	908,017	29,418	2,189,099

CHAPTER III.

PUBLIC HEALTH.

(a) HEALTH OF OFFICIALS.

TABLE III.

NATIONALITY		Number of officials employed	Number Placed on sick list	No. of days sick	Average days sickness		Died	Invalided
					For all officials	For those who were sick		
British	1951/52	1,028	553	1,573	1.53	2.85	0	6
	1952/53	1,174	142	944	0.80	6.65	1	2
Sudanese	1951/52	6,496	2,620	17,615	2.71	6.76	2	8
	1952/53	7,871	2,703	20,350	2.58	7.53	8	6
Others	1951/52	191	160	1,121	5.87	7.00	0	3
	1952/53	196	27	228	1.16	8.44	0	0

(b) GENERAL HEALTH.

Table IV illustrates a generally rising trend of work done in hospitals and dispensaries in ten years.

TABLE IV.

Work done in Hospitals and Dispensaries.

YEAR	Admissions	Attendances	Operations
1943	112,275	6,795,372	12,726
1944	131,077	7,077,919	13,796
1945	131,571	7,897,148	15,455
1946	126,586	8,474,874	15,509
1947	142,294	9,253,251	16,785
1948	140,511	9,820,304	17,573
1949	151,011	10,186,668	21,327
1950/51 (18 months)	302,526	16,503,371	31,459
1951/52	168,251	12,181,931	26,021
1952/53	164,331	13,966,390	26,114

There were 70 licensed private medical practitioners in June, 1953. The work done by them must add appreciably to the total of medical work done.

(c) VITAL STATISTICS.

No accurate census of the population of the whole country has been taken. The estimated population figures for the provinces as given in Table V must be accepted with some reserve.

An independent Department of Statistics was created. It arranged and conducted a series of pilot censuses in different parts of the country with the aim of working out methods for a large sample census to be taken in 1954.

TABLE V.

Estimated Population of Provinces.

Province	Population			
	Men	Women	Children	Total
Bahr el Ghazal	196,323	209,510	405,090	810,923
Blue Nile	525,585	633,181	864,736	2,023,502
Darfur	223,388	347,462	458,411	1,029,261
Equatoria	169,521	186,454	301,438	657,413
Kassala	236,213	241,668	357,593	835,474
Khartoum	151,805	140,897	227,417	520,119
Kordofan	474,065	609,651	876,169	1,959,885
Northern	194,139	261,951	341,050	797,140
Upper Nile	203,472	272,958	382,901	859,331
TOTAL	2,374,511	2,903,732	4,214,805	9,493,048

TABLE VI.

Estimated population of Towns of Khartoum, Omdurman and Khartoum North.

Town	Men	Women	Children	Total
Khartoum	32,498	26,150	28,156	86,804
Omdurman	35,289	44,790	52,540	132,619
Khartoum North	14,834	13,903	20,373	49,110
TOTAL	82,621	84,843	101,069	268,533

Registration of births is believed to be fairly complete in the Three Towns. Registration of deaths is probably incomplete.

TABLE VII.

Number of registered births and crude birth rate.

Khartoum, Omdurman and Khartoum North.

TOWN	No. of births	Crude birth rate
Khartoum	2,240	25.8
Omdurman	3,325	25.1
Khartoum North	1,120	22.8

(d) PREVENTIVE MEDICINE.

1. Insect-Borne Disease.

(a) *Malaria.* Rainfall in the Northern Provinces was generally heavier than in the previous seasons. Conditions in consequence were relatively more suitable for mosquito breeding and transmission of malaria. Within most towns larval control was retained as the main defence against malaria, but in rural areas reliance was largely on adult control by means of residual insecticidal sprays. As an additional protection perimeter spraying was adopted in certain towns.

B.H.C. was used as an imagocide in areas north of the Fung District. D.D.T. was used in the Fung District and Southern provinces. The use of both chemicals was enforced by earlier difficulties in obtaining adequate supplies of B.H.C. Construction of buildings in the rural north is largely mud or unburnt brick. The use of B.H.C. was determined on the assumption that its lethal effect is less neutralized than that of D.D.T. by absorption into the porous fabric. Straw or grass is the principle building material in the south and it was thought that the factor of absorption was less important.

Anopheles gambiae, believed to be the chief vector, has its peak breeding season during the rains. The aim of a residual insecticide campaign is to spray, in as short a time as possible, all rooms in a district during the start of the rains in June or July and to repeat the process after three months The scope of adult control campaigns was :—

BLUE NILE PROVINCE.

Gezira Irrigated Area: Approximately 222,000 rooms sprayed twice. White Nile Area: All riverain villages sprayed twice. East Bank Area: Large villages sprayed twice: Fung Area : Large villages sprayed twice.

DARFUR PROVINCE.

El Fasher, Nyala, Geneina and Zalengei sprayed twice.

KASSALA PROVINCE.

Kassala, Aroma and Gedaref towns and some large villages sprayed twice.

KHARTOUM PROVINCE.

Riverain villages sprayed three times ; inland villages sprayed once. A total of 40,300 rooms. Perimeters of towns sprayed once.

KORDOFAN PROVINCE.

Perimeter spraying in El Obeid and all large villages treated.

NORTHERN PROVINCE.

All riverain villages on both banks from the southern border to Abu Hamed treated twice.

In the southern provinces large towns and villages were treated. An attempt largely to substitute adult control for larva control in Juba town was not justified in its results.

The effectiveness of adult control depends entirely on the experience and diligence of staff and the skill with which campaigns are organised and supervised. It is essential that the spraying programme of a district is completed in a short period. In the Gezira Irrigated Area organisation was relatively efficient and results seemed to be good. In the White Nile District staff was less experienced, the campaign was too long drawn-out and the results may have been less satisfactory. The figures of recorded cases of malaria from 24 Gezira dispensaries in the seasons 1950/51, 1951/52 and 1952/53 furnished presumptive evidence that residual spraying was beneficial. No spraying was done in the area covered by the dispensaries in 1950/51. A complete programme was carried through in the latter years.

	1950/51	1951/52	1952/53
Cases of malaria	20,684	4,336	4,351
Mean rainfall in area	13.1″	10.2″	16.5″

/

TABLE VIII.

Species of Parasite in 11,296 *Positive Slides.*

PROVINCE	*P. falciparum*	*P. vivax*	*P. malariae*	Total
Bahr el Ghazal	1,689	6	—	1,695
Blue Nile	1,133	97	—	1,230
Darfur	675	106	—	781
Equatoria	3,476	289	29	3,794
Kassala	698	31	—	729
Khartoum	469	13	—	482
Kordofan	1,230	293	—	1,523
Northern	512	57	1	570
Upper Nile	480	12	—	492
TOTAL ...	10,362	904	30	11,296

(b) *Blackwater fever.* This condition has for some years ceased to be a serious problem. 4 cases, with 1 death, were reported.

(c) *Relapsing fever.* A sharp peak in recorded incidence was solely due to cases diagnosed at Geneina quarantine post. It was believed that all sufferers were travellers entering the Sudan from western territories of Africa. Apart from the Geneina cases only 5 cases were detected, in the Nuba Mountains.

TABLE IX.

Relapsing fever : Cases and deaths over 10 *years.*

Year	Cases	Deaths
1943	10,505	668
1944	22,672	310
1945	17,392	444
1946	1,952	65
1947	568	67
1948	287	8
1949	376	3
1950/51	36	2
1951/52	12	0
1952/53	97	14

(d) *Leishmaniasis.* Cases were recorded in every province of the Sudan except the Bahr el Ghazal, but the main centres of the disease remained curiously circumscribed. 337 cases were admitted to hospital in the northern provinces : of these 154 to Gedaref hospital, 80 to Singa hospital and 64 to Sennar hospital, comprising nearly 85.5 per cent of all cases in three areas.

The incidence was less severe in the Melut-Paloic area of Upper Nile Province than in the previous season. 124 confirmed cases were recorded. It was emphasised that restricted communications during the rains may have caused failure to discover a number of cases. Spraying with B.H.C. of houses in infected villages was undertaken as a preventive measure.

The incidence in Equatoria Province was again probably confined to Kapoeta District.

Results of treatment with Pentostam (sodium stibogluconate) remained relatively good.

TABLE X.

Leishmaniasis : Recorded incidence in 10 years.

Year	Cases	Year	Cases
1943	225	1948	460
1944	205	1949	523
1945	192	1950/51	638 (18 months period)
1946	246	1951/52	1063
1947	327	1952/53	613

TABLE XI.

Leishmaniasis 1952/53 : distribution by provinces.

PROVINCE	Cases	Deaths
Blue Nile	157	8
Darfur	12	0
Equatoria	118	9
Kassala	163	20
Khartoum	6	0
Kordofan	1	0
Northern	2	0
Upper Nile	154	16
TOTAL	613	53

(e) *Trypanosomiasis.* One case was reported in a hunter attached to the Tsetse Reclamation Survey in the Bahr el Ghazal. No evidence was elicited as to the place where infection was contracted. Otherwise the disease was confined to Equatoria Province. The infection rate in Yambio district continued to cause slight anxiety. No case was found in Meridi district. Inspections here may have been less thorough than in the year before.

TABLE XII.

Trypanosomiasis : Distribution of cases in Equatoria over 10 years.

YEAR	Yubu	Yambio	Yei	Kajo-Kaji	Meridi	Imported	Other Localities
1943	60	—	8	1	9	3	—
1944	37	—	35	—	4	—	4
1945	16	1	19	—	—	—	3
1946	21	19	16	—	—	—	—
1947	18	6	21	—	2	—	—
1948	32	23	20	—	—	—	—
1949	5	12	17	—	—	—	—
1950/51	15	33	12	—	—	—	—
1951/52	—	93	3	—	26	—	—
1952/53	2	53	13	—	—	—	—

(f) *Filariasis.* 539 cases were recorded, of which 388 were in Equatoria Province. 22 positive blood slides in the Bahr el Ghazal showed 18 *Mf. perstans* and 4 *Mf. loa loa.* In Equatoria positive slides showed 16 *Mf. bancrofti*, 12 *Mf. perstans* and 6 *Mf. loa loa.*

(g) *Onchocerciasis.* The recorded incidence of 43 cases in Equatoria and 34 in the Bahr el Ghazal does not represent the extent of parasitization. No further evidence on the extent of blindness was collected.

2. EPIDEMIC AND ENDEMIC DISEASES.

(a) *Anthrax.* Outbreaks were reported in Sennar district, Zalingei and Kuttum, Kassala, the Nuba Mountains and Bor district. Cases amongst nomad cattle owners were often difficult to trace and the recorded incidence was probably less than the real incidence. In Darfur, the Nuba Mountains and Upper Nile it was believed that infection was relatively widespread in cattle. In the Upper Nile, in addition to sheep and cattle, infection was found in zebra and tiang and it was suspected that vultures died of the disease.

All diagnosed human cases were cutaneous.

(b) *Cerebrospinal meningitis.* The massive epidemic experienced in the northern provinces during the three years previous did not recur, but there was fairly heavy sporadic infection throughout the area. There was a further severe epidemic in the Bahr el Ghazal, again attacking mainly Aweil and Raga districts. Equatoria Province once more remained almost free.

Table XIII.

Cerebrospinal Meningitis: Recorded incidence and fatality, 1952/53.

Province	Cases	Deaths	Fatality rate
Blue Nile	432	154	35.7
Darfur	504	105	20.8
Kassala	89	14	15.7
Khartoum	22	0	—
Kordofan	613	149	24.3
Northern	66	12	18.2
Total Northern Provinces	1,726	434	25.1
Bahr el Ghazal	1,055	195	18.5
Equatoria	12	2	16.6
Upper Nile	145	13	8.96
Total Southern Provinces	1,212	210	17.3
Overall Total	2,938	644	21.9

The fatality rates generally compare unfavourably with rates of under 14 percent experienced in recently past epidemics. The habit of rural life in the Bahr el Ghazal, with its general avoidance of village congregation, makes treatment of an outbreak difficult. A higher fatality rate in sporadic outbreaks than in big epidemics has been noted in the past. It may be partly due to delay in establishment of treatment when full scale epidemic control schemes are not in operation. It was not thought that there was any evidence of development of a drug-resistant strain of infecting organism.

TABLE XIV.

Cerebrospinal Meningitis: Recorded incidence and fatility in 10 *years.*

YEAR	Recorded cases	Recorded deaths	Fatality rate
1943	3,526	765	21.7
1944	2,346	405	17.3
1945	6,166	666	10.8
1946	730	155	21.2
1947	443	159	35.9
1948	170	59	34.7
1949	353	102	28.9
1950/51 (18 months)	57,575	7,710	13.4
1951/52	14,527	2,031	14.0
1952/53	2,938	644	21.9

(c) *Diphtheria.* 717 cases were notified. Khartoum (437 cases, mainly in Omdurman), the Gezira (91 cases) and Kordofan (60 cases) were main centres of infection. The diagnosis was not confirmed bacteriologically and was regarded as doubtful in 49 cases recorded in the Nuba area. The same was probably true in other areas. The disease was generally relatively mild. The recorded fatality rate was under 5.2 per cent.

TABLE XV.

Diphtheria: Recorded incidence and fatality, 1952/53.

PROVINCE	Cases	Deaths
Bahr el Ghazal	4	0
Blue Nile	116	20
Darfur	17	0
Equatoria	14	2
Kassala	19	4
Khartoum	437	1
Kordofan	60	0
Northern	38	9
Upper Nile	12	1
TOTAL	717	37

TABLE XVI.

Diphtheria: Recorded incidence and deaths in 10 *years.*

YEAR	Cases	Deaths
1943	309	45
1944	270	61
1945	389	54
1946	390	61
1947	319	37
1948	326	27
1949	264	36
1950/51 (18 months)	573	77
1951/52	280	30
1952/53	717	37

(d) *Dysentery.* It has not been attempted to differentiate in the records between amoebic and bacillary dysentery. The conditions under which many cases were treated prevented accurate diagnosis. One is left with the suspicion that a number of cases are unnecessarily given emetin. 4,015 cases were admitted to hospital and 56,218 recorded in outpatient centres.

(e) *Enteric fever.* The incidence of this disease, despite fewer cases notified in Khartoum, again showed a disquieting rise. The generally upward trend of incidence in the Sudan may be an indication that often primitive sanitation systems are with difficulty able to cope with the pressure of a fast-rising urban population. Increased communication facilities may have caused dissemination of infection.

The Local Government Authority in Omdurman recognised the failure of available sanitary measures to prevent risk of infection by instituting a large scale immunisation campaign. Over 60,000 persons were given T.A.B. vaccination.

Enteric fever is endemic in the Gezira Irrigated Area, mainly around the neighbourhood of Abu Usher. There was a sharp epidemic, comprising 65 cases, in Kamlin during December, 1952. The origin of the outbreak was traced to a school-boy who had been diagnosed and treated in private with inadequate dosage of chloromycetin. Symptoms were suppressed without eradication of infection. On his return to boarding school he carried the disease to his fellow pupils. 30 children in the school were infected.

The epidemic was finally checked by stringent sanitary precautions, an intensive campaign of fly destruction and mass immunisation of over 4,000 persons with T.A.B. vaccine.

TABLE XVII.

Enteric fever: Distribution 1952/53.

PROVINCE	Cases	Deaths
Bahr el Ghazal	2	0
Blue Nile	158	9
Darfur	3	2
Equatoria	13	0
Kassala	34	2
Khartoum	233	42
Kordofan	4	0
Northern	90	5
Upper Nile	61	3
TOTAL	598	63

TABLE XVIII.

Enteric fever: Incidence in 10 *years.*

YEAR	Recorded Cases
1943	145
1944	199
1945	183
1946	116
1947	144
1948	202
1949	311
1950/51 (18 months)	560
1951/52	578
1952/53	598

(f) *Gastro-enteritis of children.* 1,382 cases were admitted to hospital with, under conditions of hospital treatment, a fatality rate of 9.4 per cent. 40,606 were recorded in outpatient units. The diagnosis may be only a symptom of a number of infections. The condition was a major cause of mortality in childhood.

(g) *Leprosy.* There was no doubt that the value of sulphone therapy gained public appreciation. 181 lepers were under treatment in Lui Settlement. There were 31 symptom free discharges, 7 men and 24 children. 50 cases were under treatment in Torit settlement 10 were discharged as symptom free. 16 cases were isolated in Omdurman and 19 were treated as out-patients. 12 were discharged as symptom free.

It may have been that criteria as to freedom from symptoms were sometimes optimistically applied. Only a subsequent and prolonged follow-up of discharged cases will enable an ultimate judgment on the value of sulphones to be made.

A sample leprosy survey in the Ingessana Hills tended to confirm the opinion that there are 500 to 600 lepers in this area. Conditions in the district were not considered suitable for institution of a domiciliary treatment scheme.

Without a comprehensive survey for which staff and facilities were lacking it was impossible to form a real estimate of the number of lepers in the Sudan. Abbott considered that the incidence amongst the Azande was about 5.2 per cent. A survey in the Moro district indicated that the incidence was about 2 per cent of the population. The figures for " known cases " in Table XIX were certainly considerably under the actual total.

TABLE XIX.

Leprosy : 1952/53.

PROVINCE	Total known cases	Total in Settlements		Positive new cases found during the year.
		Govern-ment	Mission.	
Bahr el Ghazal	180	148	—	8
Blue Nile	82	38	—	30
Darfur	80	67	—	17
Equatoria	5,357	1,098	170	574
Kassala	38	35	—	21
Khartoum	70	—	10	13
Kordofan	2,166	56	—	14
Northern	28	—	—	28
Upper Nile	23	17	—	6
TOTAL	8,024	1,459	180	711

(h) *Poliomyelitis.* 6 acute cases were recorded as hospital admissions

(i) *Rabies.* 20 cases of human hydrophobia were reported. There was an alarming number of cases of animal rabies in Khartoum. 67 cases were diagnosed by laboratory examination. 9,040 dogs not under control were destroyed. A case of canine rabies occurred in Torit district, the first to be notified for many years in this area.

(j) *Smallpox*. The epidemic, which began in Darfur in 1951/52, spread and assumed major proportions. Control of epidemic disease in this province is always difficult due to its vast areas, scattered inhabitants, large itinerant element of population and poor communications.

It is possible that the potency of the vaccine suffered due to the necessity for keeping and transporting it without refrigeration. There was a coincident epidemic in French Equatorial Africa and intercourse between the two territories along the whole length of the frontier is inevitable.

3,653 cases, with 578 deaths, were notified, a fatality rate of 15.8 per cent. Distribution of cases in districts of the province was :—

Western District	2,129
Dar Masalit	1,135
Northern District	190
Southern District	186
Central District	13

The general trend of spread was from the western frontier district of Dar Masalit throughout the rest of the province.

The monthly incidence of notifications was :—

July, 1952	121
August, 1952	85
September, 1952	63
October, 1952	156
November, 1952	275
December, 1952	323
January, 1953	767
February, 1953	726
March, 1953	572
April, 1953	333
May, 1953	196
June, 1953	36

Inoculation with material from a case as a preventive measure is a Fur tradition. It was apparently much practised and was difficult to stop. It was held to have played a major part in spread of infection.

Five teams were engaged throughout the year in vaccination. The number of vaccinations done was :

Western District	297,967
Dar Masalit	74,745
Northern District	4,791
Southern District	317,125
Eastern District	15,403
Disa Quarantine (Geneina)	7,690
Fasher Town	37,410
Fasher Control Station	63,350
TOTAL	818,481

115,679 vaccinations were done in the latter months of 1951/52.

It was satisfactory that the epidemic was confined to Darfur. Only 17 cases were reported in provinces other than Darfur, of which 13 were presumed alastrim in the southern provinces. The latter disease was notified in Torit for the first time after many years.

190,100 vaccinations were done in provinces other than Darfur.

(k) *Tetanus.* The condition was not uncommon throughout the country. 44 of a total of 130 cases were in the thickly populated and intensively cultivated Gezira Irrigated Area. 36 deaths were reported. Prophylactic serum was used in some cases of injury.

Tetanus is relatively frequently seen in animals.

(l) *Tuberculosis.*

TABLE XX.

Tuberculosis : Admissions to hospital in 10 years.

YEAR	Pulmonary	Non-Pulmonary	Total
1943	593	529	1,122
1944	796	632	1,428
1945	957	643	1,600
1946	888	613	1,501
1947	877	599	1,476
1948	1,019	604	1,623
1949	1,176	650	1,826
1950/51	1,611	883	2,494
			2,494 (18 months)
1951/52	1,325	747	2,072
1952/53	1,679	671	2,350

Admissions to hospital do not represent the full diagnosed incidence of the disease as many cases are referred for domiciliary care. The general trend of increase in admissions for tuberculosis is paralleled by the general increase in work done in hospitals. To a large extent admissions for tuberculosis vary with the number of tuberculosis beds available.

TABLE XXI.

Tuberculosis : Admissions to hospital 1952/53 *in provinces.*

PROVINCE	Pulmonary	Non-Pulmonary	Total
Bahr el Ghazal	71	29	100
Blue Nile	298	151	449
Darfur	56	15	71
Equatoria	146	38	184
Kassala	269	119	388
Khartoum	402	95	497
Kordofan	178	100	278
Northern	192	94	286
Upper Nile	67	30	97
TOTAL	1,679	671	2,350

(Note : the figures for pulmonary tuberculosis in Khartoum may be weighted by cases from other provinces coming to the capital for specialist treatment).

The total number of cases diagnosed is shown in Table XXII. Some of the diagnoses in rural areas may have been made without radiological or bacteriological investigation and are open to doubt.

TABLE XXII.

Tuberculosis 1952/53 : *Distribution of all cases diagnosed.*

PROVINCE	Pulmonary	Non-Pulmonary	Total
Bahr el Ghazal	106	61	167
Equatoria	250	52	302
Upper Nile	143	158	301
Total Southern Provinces ...	499	271	770
Blue Nile	502	542	1,044
Darfur	80	42	122
Kassala	351	391	742
Khartoum	940	678	1,618
Kordofan	404	246	650
Northern	358	180	538
Total Northern Provinces ...	2,635	2,079	4,714

The diagnosed incidence per 1,000 of the estimated population was :—

Southern Provinces	0.33
Northern Provinces	0.66

Tuberculosis of cattle is very rare in the Sudan. It is probable that all forms of tuberculosis in man were due to the human type of organism. The source of infection in both pulmonary and non-pulmonary tuberculosis was probably almost exclusively an open case of human tuberculosis.

As previously noted pulmonary and non-pulmonary tuberculosis were predominantly found in early and middle adult life. Cases in infancy and youth were comparatively rarely diagnosed. This phenomenon has not yet been altered by a fairly extensive examination of contacts in the Khartoum Chest Centre.

TABLE XXIII.

Tuberculosis : *Age distribution of cases admitted to hospital.*

	AGE PERIODS.							Over 65	Undefined.
	0-1	1-5	6-15	16-25	26-35	36-45	46-65		
Northern Provinces.									
Pulmonary ...	4	6	33	370	472	204	141	29	8
Non-Pulmonary ...	7	27	63	116	156	83	53	8	1
Southern Provinces.									
Pulmonary ...	—	4	11	72	154	91	32	—	—
Non-Pulmonary ...	—	12	29	27	36	17	11	—	—
Non-Sudanese.									
Pulmonary ...	—	—	—	15	16	7	3	3	4
Non-Pulmonary ...	—	—	1	7	10	3	4	—	—

TABLE XXIV.

Site of main lesion in 671 cases of non-pulmonary tuberculosis admitted to hospital.

Site of Lesion.	Northern Provinces	Southern Provinces	Foreigners	Total
Gland	164	104	9	277
Bone	181	76	12	269
Joint	44	25	1	70
Abdomen	17	14	1	32
Skin	5	7	1	13
Genito-urinary	5	3	—	8
Meninges	2	—	—	2
TOTAL	418	229	24	671

An Advisor in Tuberculosis from the Eastern Mediterranean Region, World Health Organization, visited Khartoum in January, 1953. Arrangements with the Organisation for initiation of a B.C.G. vaccination campaign were delayed. The Government signified to the Organisation its readiness to start a campaign at the convenience of the Organisation.

KHARTOUM CHEST CENTRE.

Work in the Khartoum Chest Centre increased. A second physician was appointed in April, 1953.

The following beds were available for tuberculosis cases in the Three Towns :

River Hospital	63
Khartoum Hospital	13
Omdurman Hospital	13
Khartoum North Hospital	12
Hamad el Nil Isolation Hospital	67
TOTAL	168

1,259 cases of pulmonary tuberculosis were diagnosed compared with 902 in 1951/52. The total was swollen by many patients who had made their way to the centre from outside provinces. Numbers of such had disease advanced beyond treatment.

It was not possible to provide residential treatment for all patients diagnosed at the Centre. Only 230 were admitted to hospital. The remainder were placed under domiciliary care or set back to their homes outside Khartoum.

A combination of Isoniazid and P.A.S. was used extensively in routine treatment in both hospital and domiciliary practice. Streptomycin in combination with one or both of these drugs was restricted mainly to hospital practice and was largely kept in reserve to " cover " surgical treatment and for reactivations after collapse therapy.

The following is a summary of the work done by the Chest Centre —

Cases under domiciliary care at 30.6.1953		226
Cases admitted to hospital		230
Discharged from hospital		246
(a) Quiescent and fit for light work	158	
(b) Transferred to other units or sent home as unlikely to benefit from residential treatment	38	
(c) Lost trace	50	
Died in hospital		37
No. of outpatients seen		2,928
(a) Pulmonary tuberculosis	1,259	
(b) Non-Pulmonary tuberculosis	120	
(c) Non-tuberculous chest conditions and contacts under surveillance	1,549	
New contacts examined		682
Total contacts under surveillance at 30.6.1953		1,278
No. of home visits by Tuberculosis Visitors		2,048
Screening examinations		3,038
Tuberculin tests		620

The Sudan Association for Prevention of Tuberculosis continued to do estimable work. Home assistance given to families of sufferers from tuberculosis amounted to £E. 66 monthly.

(m) *Undulant fever.* An outbreak of Malta fever in the Gezira was investigated in co-operation with the Veterinary Service. Cows and goats were found to be fairly commonly infected with *Brucella melitensis.* 15 human cases were admitted to Medani hospital. In most the source of infection appeared to be milk from apparently healthy cows. Destruction of infected beasts with payment of compensation was undertaken.

3. HELMINTHIC DISEASES.

(a) *Ancylostomiasis.* 9,009 cases were treated, of which 8,111 were in the two southernmost provinces where the condition remained a serious cause of invalidism. There remained a persistent focus in Dongola District.

(b) *Dracontiasis.* 4,373 cases were reported. Equatoria, the Nuba Mountains and the Bahr el Ghazal were the chief centres of infection.

(c) *Schistosomiasis.* An examination of patients attending hospitals revealed the infection rate recorded in Table XXV. The samples were selected to the extent that in many cases complaints of urinary or intestinal symptoms prompted the examination.

TABLE XXV.

Incidence of Schistosomiasis discovered in routine examination in hospitals.

Province	S. haematobium		S. mansoni	
	No. examined	% incidence	No. examined	% incidence
White Nile Area	9,020	5.4	8,777	3.6
Darfur	8,767	12.2	953	4.7
Kassala	12,997	2.7	5,555	0.5
Khartoum	35,306	1.7	5,590	5.0
Kordofan	37,517	14.1	14,310	0.2
Northern	41,375	5.8	7,181	0.4
Upper Nile	1,770	2.1	1,520	2.5

In the Bahr el Ghazal all cases discovered, except 3 imported cases of *S. haematobium* parasitization, were due to *S. Mansoni* and in Equatoria all cases were due to *S. Mansoni.*

TABLE XXVI.

Total attendances of new cases of Schistosomiasis in hospitals and dispensaries.

Province	No. of cases
Bahr el Ghazal	229
Blue Nile	11,493
Darfur	4,079
Equatoria	3,801
Kassala	440
Khartoum	968
Kordofan	4,913
Northern	3,272
Upper Nile	91
TOTAL	29,286

It has been difficult to estimate the amount of disability attributable to schistosomiasis. Pathological research led to an extension of knowledge of the possibily occasional grave effects of parasitization on the lungs, heart and central nervous system. On the other hand it is certain that large numbers infected with schistosomiasis do not suffer with symptoms sufficiently severe to cause them to seek treatment. In irrigated areas the numbers found by survey to be passing viable eggs is generally much in excess of the numbers seeking treatment.

Engaged in a control scheme in the Gezira Irrigated Area were four survey teams, six treatment teams and four sulphation gangs. The control scheme since its inception in 1949 has concentrated on ten blocks constituting about one-fifth of the whole of the Irrigated Area. The staff was under the immediate direction of a public health officer employed fulltime on this work.

It appeared that four survey teams were able to examine each village in the ten blocks once a year ; six treatment teams were able to treat each village only once in two years ; four sulphation gangs employed full time were able to sulphate every canal twice a year.

Twice yearly sulphation is not adequate to eradicate snails. They reappear in treated canals within two months of completion of sulphation. Nonetheless the results, shown in Table XXVII, suggested that the partial control adopted was effective in reducing the incidence of infection.

TABLE XXVII.

Schistosomiasis survey in controlled area of Gezira Irrigated Area.

Year	No. of villages examined	Total population	% infected
1949	34	9,668	27.5
1950/51	80	25,155	15.7
1951/52	61	20,008	11.9
1952/53	73	25,845	10.6

Sulphation of canals was done during eight months of the year. All canals in the controlled area were treated once and approximately a half were treated twice. 145 channels with a total length of 725 kilometres were treated.

Palm leaf traps were used to reduce the snail population in canals. Channels were first cleared of floating weed before traps were placed in them. The snail density was assessed by means of sampling every 15 days, the sample consisting of 10 " dips " with a hand net. The effectiveness of trapping was tested in 39 canals. Results are shown in Table XXVIII.

TABLE XXVIII.

Effect of palm leaf traps on snail density in canals.

Total Snails in Sample

	Bullinus spp.	Planorbis spp.	Total
First sample	4,116	4,676	8,792
Second sample (15 days)	2,577	2,815	5,392
Third sample (30 days)	1,630	1,870	3,500
Fourth sample (45 days)	1,041	1,225	2,266

Continuous addition of copper sulphate at the entry to a minor canal appeared to prevent entry of snails into the canal, but had no discernible effect on snails already in the canal.

Traps made of an iron grid frame and interlaced with palm leaves were placed in the mouth of minor canals. Large numbers of snails adhered to the traps and entry of snails into the canal appeared to be prevented.

E. SANITARY CIRCUMSTANCES.

Water supplies. Progress was made with the purified water installation in Wau. 39 anti-guinea worm wells were constructed in the Bahr el Ghazal.

Investigation preparatory to installation of a piped supply in Meridi was undertaken.

3,677 connections of piped water were made to new houses in Khartoum, Omdurman and Khartoum North. Daily bacteriological investigation of the water supply of the Three Towns indicated that the purification process was satisfactory. Occasional bacteriological checks of other piped supplies were undertaken.

The Rural Water Supplies and Soil Conservation Board continued a large programme of well boring and hafir excavation. The Board was fully alive to the necessity of safeguarding water stored in hafirs. The problem of finding an easy and indestructible means of lifting water from hafirs was not fully solved.

Refuse disposal. Tipping and open burning remained the method of choice. Local Government Authorities continued to display readiness to introduce mechanisation of this service. Mechanisation sometimes proved an expensive embarrassment in districts lacking an adequate vehicle maintenance organisation.

Sewage disposal. Work was started on installation of a water carriage disposal system in Khartoum.

Conversions and new installations of flushless septic tank plants by Atbara Town Council numbered 640. In suitable soil the installation was most satisfactory given a high standard of masonry work and meticulous expert inspection of each stage of construction.

Experimental water privies were built in Kassala and Kordofan. A communal latrine of this type was successful in Malakal. In the Three Towns they were made in Sudan Defence Force, Police and warders quarters. Omdurman Municipal Council prohibited installation of new bucket latrines and increased the rate chargeable for this form of convenience in an effort to encourage private householders to build water privies.

Khartoum Municipality mechanised a large part of the latrine bucket collection service by substituting the traditional camel cart with flat trailers drawn by Scammel Mechanical Horse Vehicles. The innovation was not an unmixed success.

Chemical closets were installed by certain private householders and firms in Khartoum. They were judged unsatisfactory.

Flies. Fly-breeding occurred in over 50 per cent of the pit latrines in Omdurman. A misguided attempt to abate the nuisance with B.H.C. dust was temporarily effective, but soon resulted in a resistant strain of fly. Examination of Omdurman flies in the London School of Tropical Medicine and Hygiene and the laboratories of Imperial Chemical Industries Ltd. showed that 98 per cent were resistant to B.H.C. and D.D.T. Resistance was persistent in successive generations.

Housing and Town Planning. The slum clearance scheme in Khartoum Deims was nearly completed. A clearance and redevelopment scheme of the Morada sector of Omdurman, involving some 300 families, was put in train. Nine blocks in the old part of Khartoum North of the railway wing were re-planned. Demolition of the unhygienic Suk el Arabi in Khartoum was started.

Approximately 300 grass houses and a part of the hospital in Fasher were destroyed by fire.

Progress was made with Kassala town re-development plan.

There was extensive development of the first class area in El Obeid. A part of the Native Lodging Area was re-classified as Third Class Building Land and re-development with a better standard of dwelling started.

The main market of Atbara Town was in the process of re-development.

Food in relation to health. Frank deficiency disease was infrequently recorded. The amount of ill-health that results from imperfect nutrition needs further investigation. There is probably no certainty as to an optimum diet for all sections of the population in the Sudan.

Rainfall in the Northern Provinces was generally good. Few scarcities of staple crops were reported. There was said to be some hardship in Western Kordofan where water scarcity prevented harvesting of rain-grown grain. Too great concentration on cash crops in some areas may have had a detrimental effect on nutrition. The growing popularity of pulses as food was encouraging.

Teaching staff of the Faculty of Medicine carried out an investigation of dental fluorosis and a nutritional survey on two visits to Abu Deleig. The fluorine content of the water in many of the wells was abnormally high.

Evidence of dental fluorosis was reported from Abu Usher district.

Outbreaks of food poisoning were fairly common in and around the Three Towns. Milk was the usual vehicle and the incriminated organism was an exotoxin-producing *Staphylococcus aureus.* Cases of poisoning due to *Salmonella* spp: were attributed to infected meat.

Industrial hygiene. There was considerable expansion of the Industrial Areas of the Three Towns. A large modern soap factory employing the boiling process, started work in Khartoum North. Disposal of waste water from industrial installations created some difficulty.

Steps were taken to enforce the provisions of the Employment of Children Ordinance, 1929.

The meat factory at Kosti came into operation. No public health difficulties have arisen.

There was a satisfactory freedom from accident in Nzara textile factory.

CHAPTER IV.

SOCIAL HYGIENE.

Midwifery. 25 midwives were trained in Omdurman School, 4 in El Obeid School and 3 in Juba School. Training of midwives has been started in Malakal by the Roman Catholic Mission. Pupils of the school are required to pass a proficiency test conducted by Ministry of Health staff before being licensed.

TABLE XXIX.

Distribution of licensed midwives trained in the Sudan 30.6.1953.

	District midwives	Certificated nurse midwives	Uncertificated nurse midwives	Health visitors	Total
Bahr el Ghazal ...	—	2	—	—	2
Blue Nile ...	90	9	2	6	107
Darfur ...	28	2	—	1	31
Equatoria ...	2	3	7	—	12
Kassala North ...	12	3	1	1	17
Kassala South ...	20	1	3	—	24
Khartoum ...	98	30	—	6	134
Kordofan ...	53	4	5	1	63
Northern ...	102	3	2	1	108
Upper Nile ...	6	2	—	—	8
TOTAL ...	411	59	20	16	506

Maternal and Child Welfare. Four women doctors were engaged in welfare services, at Wad Medani, Juba, Port Sudan and Khartoum. Sudanese health visitors were posted in the following stations :—

Khartoum	4
Omdurman	2
Khartoum North	1
Wad Medani	1
Kosti	1
Port Sudan	1
El Obeid	1
Atbara	1

In addition 2 Sudanese health visitors and 1 British health visitor were seconded to the Ministry of Education for work in the Gezira Adult Education Scheme.

A woman doctor was appointed by the Save the Children Fund to head the team working in Torit. The team consisted of one doctor and two welfare workers. Sessions were held at 2 centres in Torit and 3 in adjacent villages. The primary aim of the work was to investigate the causes of the high infant mortality rate amongst the Latuka people.

The Medical Officer, Li Yubu, was engaged in a study of the reputed infertility of the Zande tribe.

The following welfare centres were in operation :—

Wau	Ante-natal	
Medani	Ante-natal (2)	Child welfare (2)
Kosti	Ante-natal	Child welfare
Dueim	Ante-natal	Child welfare
Sennar	Ante-natal	
Roseires	Ante-natal	
El Fasher	Ante-natal	Child welfare
Nyala	Ante-natal	Child welfare
Juba	Ante-natal (2)	Child welfare (2)
Lui (C.M.S.)	Ante-natal	Child welfare
Amadi (C.M.S.)	Ante-natal	Child welfare
Kassala	Ante-natal	
Gedaref	Ante-natal	
Port Sudan	Ante-natal	Child welfare
Khartoum	Ante-natal (4)	Child welfare (4)
Omdurman	Ante-natal (4)	Child welfare (4)
Khartoum North	Ante-natal (2)	Child welfare (2)
Khartoum Rural District	Ante-natal (4)	Child welfare (4)
El Obeid	Ante-natal	Child welfare
Nahud	Ante-natal	
Kadugli	Ante-natal	Child welfare
Dilling	Ante-natal	
Talodi	Ante-natal	
Abri (S.U.M.)	Ante-natal	Child welfare
Heiban (S.U.M.)	Ante-natal	Child welfare
Atbara	Ante-natal (2)	Child welfare (2)
Damer	Ante-natal	Child welfare
Darmali	Ante-natal	Child welfare
Malakal	Ante-natal	

School Medical Service. The growth of education has outrun the capacity of Medical Services to provide a full school medical service. The number of pupils inspected was :—

Bahr el Ghazal	358
Blue Nile	15,478
Darfur	4,696
Equatoria	3,415
Kassala	7,374
Khartoum	9,215
Kordofan	8,193
Northern	7,014
Upper Nile	2,090
TOTAL	57,833

There is a school dental service only in Khartoum Province. 3,054 boys and 571 girls were examined by the dental surgeon. 1,449 boys and 217 girls required treatment.

Mental Health. An Advisor in Mental Diseases of the World Health Organisation visited the Nervous Diseases Centre and submitted a long and useful report on mental health in the Sudan.

A medical assistant and two nursing orderlies working in the centre and the Criminal Lunatic Asylum were granted fellowships by the World Health Organisation for a period of two months study of mental nursing at Beyrut.

The Nervous Diseases Centre was sufficiently equipped for treatment of common psychologic-psychiatric disorders by electro-convulsion, electronarcosis, pharmacologic abreactions and modified insulin treatment. It provided only for outpatient treatment.

The number of cases seen during the year was :—

New Cases	1,224
Return attendances	3,666
	4,890

3,260 of the cases were neuroses ; 1,630 were psychoses. There were 2,930 males and 1,960 females. Of all cases 4,369 were adults and 521 were children.

There was accommodation for 160 cases, including 100 cells, in the Criminal Lunatic Asylum. Ward cases lived in association in small selected groups based on geographical or clinical peculiarities. Occupational and recreational facilities were available on a small scale for ward cases.

Electroconvulsion treatment and electronarcosis was made available in the treatment rooms.

The number of inmates at 30.6.1953 was 94, of whom 85 were males and 9 females.

21 males and 5 females were admitted during the year.

42 males and 6 females were discharged during the year.

85 cases were examined by the Mental Diseases Board.

Cases were classified as follows :—

Schizophrenia	18
Delusional insanity	10
Chronic alcoholism	3
Senile dementia	7
Epilepsy	4
Hypomania	5
Manic-depressive	5
Psychosomatic	3
Toxic delirium	4
Hashish psychosis	1
Mental defectives	4
Mentally normal	8
Re-examinations	13

Health Education. Management of the Graphic Museum was assumed by the Head of the Public Health Department of the Faculty of Medicine under direction of the Ministry of Health.

In co-operation with the Public Relations Office a short film " Prevention of Tuberculosis " was made. An earlier production " Kill that Fly " was popular.

The effectiveness of radio broadcasts and press articles was evidenced when approximately one-half of the population of Omdurman was persuaded to submit to T.A.B. vaccination.

CHAPTER V.

PORT HEALTH. QUARANTINE.

No seaport or airport was declared infected.

Disinsection of aircraft and quarantine control of air travellers was undertaken at Wadi Halfa, Port Sudan, Khartoum, Juba, Malakal, Geneina and El Fasher airports.

The *Aedes aegypti* index was calculated on an inspection of all habitations within the area. Table XXX shows the *Aedes aegypti* index throughout the year at certain airports on international routes.

TABLE XXX.

Aedes aegypti index—1952/53.

Month	Fasher	Juba	Kassala	Port Sudan	Khartoum	El Obeid	Wadi Halfa	Malakal
July ...	—	0.33	0.03	—	—	—	—	0.2
August ...	—	0.80	—	—	—	0.02	—	0.2
September ...	—	0.80	—	—	—	0.002	—	0.4
October ...	—	0.90	—	—	—	—	—	0.05
November ...	—	—	0.01	—	—	—	—	—
December ...	—	—	—	—	—	—	—	—
January ...	—	—	—	—	—	—	—	—
February ...	—	—	—	—	—	—	—	—
March ...	—	—	—	—	—	—	—	—
April ...	—	—	—	—	—	—	—	—
May ...	—	—	—	—	—	—	—	—
June ...	—	—	—	—	—	—	—	—

A draft Quarantine Bill, intended to bring Sudan Sanitary Legislation up to date and in line with World Health Organisation International Sanitary Regulations was prepared for submission to the legislature.

Port Sudan Quarantine. 1,105 ships entered Port Sudan harbour. Radio pratique was granted to 550 ships. No case was isolated or placed under surveillance.

Suakin Quarantine. The number of pilgrims that has been recorded leaving Suakin in the past 10 years has been :—

1943/44	17,818
1944/45	6,999
1945/46	6,214
1946/47	8,404
1947/48	12,020
1948/49	11,105
1949/50	5,091
1950/51	4,374
1951/52	6,047
1952/53	15,051

In addition, during 1952/53, 570 pilgrims left Port Sudan for the Hedjaz by air.

All outgoing pilgrims were immunised against cholera, smallpox and yellow fever.

The pilgrimage was declared uninfected.

Returning pilgrims were detained in quarantine only while medical formalities were undertaken.

Wadi Halfa Quarantine. 2,151 persons were examined 392 were detained in quarantine. 446 river vessels were inspected.

Geneina Quarantine (*Disa*). 10,314 persons passed through the post. All were disinsected with D.D.T. louse powder. Those without evidence of immunisation against smallpox were vaccinated and kept under observation for 14 days.

Medical Mission to the Hedjaz. The mission consisted of two doctors with auxiliary staff. Treatment centres were formed at Jeddah, Mecca, Muna and Medina. Medical aid was given to many nationalities including pilgrims and local population. The number of out-patients seen was :—

	Men	Women	Children	Total
Jeddah	968	1,617	1,256	3,841
Mecca	1,800	760	473	3,033
Muna	1,210	1,782	925	3,917
Medina	1,988	2,141	870	4,999
TOTAL	5,966	6,300	3,524	15,790

63 persons were admitted to field hospitals for treatment.

CHAPTER VI.

HOSPITALS, DISPENSARIES, OTHER UNITS.

TABLE XXXI.

Number of hospitals and beds available.

Province	Number of hospitals	Beds in hospitals	Beds in dispensary	Total beds	Beds per 1000 population
Bahr El Ghazal ...	2	364	285	649	0.80
Blue Nile	7	1,141	87	1,228	0.67
Darfur	3	400	186	586	0.57
Equatoria	8	1,000	565	1,565	2.38
Kassala	3	708	165	873	1.04
Khartoum	7	1,019	24	1,043	2.01
Kordofan	5	689	553	1,242	0.63
Northern	6	682	4	686	0.86
Upper Nile	1	254	130	384	0.45
TOTAL ...	42	6,257	1,999	8,256	0.87

(The above includes mission hospitals).

No new hospital was opened. The hospital in building at Bor neared completion. The new teaching hospital in Khartoum reached roof level.

Medical Services buildings completed during the year included :—

Province	Locality	Buildings constructed
Bahr El Ghazal ...	Wau	3 houses for officials.
,, ,, ,, ...	,,	Housing for employees.
,, ,, ,, ...	,,	2nd. instalment of public health office.
Blue Nile ...	Medani	3 houses for officials.
,, ,, ...	,,	Midwives training school.
,, ,, ...	Rufaa	2 wards.
,, ,, ...	Abu Usher	1 house for official.
,, ,, ...	,, ,,	Housing for employees.
,, ,, ...	Sennar	Housing for dispensary staff.
,, ,, ...	Singa	Housing for dispensary staff.
,, ,, ...	Roseires	Isolation block.
,, ,, ...	,,	Ward annexes and store
,, ,, ...	Kosti	House for official.
Darfur	Fasher	Sisters' office and staff lecture room. Pantry.
Darfur	Nyala	3 wards.
Equatoria	Li Rangu	Housing for employees.
Kassala	Kassala	House for official.
,, ...	,,	Tuberculosis wards.
,, ...	,,	Public health offices.
,, ...	,,	Welfare centre.
,, ...	Port Sudan	2 houses for officials.
,, ...	,, ,,	Kitchens and stores for employees.
Khartoum ...	Khartoum	School of Hygiene and students hostel.
,, ...	Omdurman	Re-conditioning sub-standard wards
,, ...	,,	Conversion of east wing of male wards to paying wards.

Province	Locality	Buildings constructed
Kordofan	El Obeid	Extension of out-patient department.
,, ...	Um Ruaba	Ward.
,, ...	Rashad	Ward.
Northern	Atbara	2 houses for officials.
Northern	Damer	House for official
Upper Nile ...	Malakal	Isolation block.

Table XXXII shows new dispensaries and dressing stations built and dispensaries re-built, enlarged or otherwise improved.

TABLE XXXII.

New dispensaries, dressing stations, improvement to dispensaries.

Province	New dispensaries	New dressing stations	Dispensaries improved
Bahr El Ghazal	1	1	1
Blue Nile	2	4	7
Darfur	3	1	1
Equatoria	—	—	2
Kassala	3	2	1
Khartoum	—	—	—
Kordofan	2	2	4
Northern	—	1	3
Upper Nile	3	—	2
TOTAL	14	11	21

Dental Unit. The unit consisted of 3 dental surgeons and a dental mechanic. Two Sudanese apprentices began training as dental mechanics. Sessions were held in Khartoum and Omdurman Hospitals. The Senior Dental Surgeon undertook tours to provincial centres. A fourth dental surgeon was employed in the school dental service in Khartoum Province.

CHAPTER VII.

MEDICAL MISSIONS.

The work reported by medical missions is shown under :—

	In-patients	Out-patients	Operations
CHURCH MISSIONARY SOCIETY.			
Omdurman (Khartoum Province) ...	1,478	40,532	313
Salara (Kordofan)	253	25,493	—
Katcha (Kordofan)	671	17,146	—
Lui (Equatoria)	1,287	46,608	360
AMERICAN MISSION.			
Nasir (Upper Nile)	—	46,806	—
Akobo (Upper Nile)	—	4,313	—
SUDAN UNITED MISSION.			
Tabaniya (Kordofan)	—	6,060	—
Kauda (Kordofan)	108	8,423	—
Heiban (Kordofan)	372	31,513	—
Moro (Kordofan)	361	9,009	—
SUDAN INTERIOR MISSION.			
Abayath (Upper Nile)	—	4,891	—
Banjang (Upper Nile)	—	401	—
	4,530	241,195	673

CHAPTER VIII.

MEDICAL TRAINING.

(i) *Kitchener School of Medicine.*

The University College had appointed a full teaching staff for the opening of term in September, 1952. Clinical teaching is done in hospitals of the Ministry of Health. The Ministry was responsible for working out the system of availability of teaching facilities.

(ii) *School of Hygiene.*

Excellent new premises were built and opened. The hostel was extended to accommodate 30 students.

Number of students :

First year	10
Second year	9
Third year	7

First year students entered the Khartoum Technical Institute for the initial year of their training.

7 candidates sat for the examination for the Certificate of the Royal Sanitary Institute in January, 1953. 5 were successful.

17 sanitary overseers passed their proficiency test after a course of training in the school.

3 students sent by the Libyan Government on World Health Organisation Fellowships were accepted for training as sanitary overseers.

(iii) *Medical Assistants' Training School, Omdurman.*

Due to the lengthening of the course there was no final proficiency test during the year. There were 50 students under training, divided into two years.

(iv) *Laboratory Assistants Training.*

2 laboratory assistants completed a 3 year course in the Stack Medical Research Laboratories during the year and were promoted to former Scale H. 5 laboratory assistants were given advanced courses and promoted to former Scale J.

(v) *School of Dispensers.*

The school moved into a commodious laboratory attached to the Graphic Museum. The move was made possible by the transfer of the School of Hygiene to the new premises. 5 students were under training.

(vi) *Radiographers.*

5 students were under training.

(vii) *Juba Training Centre.*

Medical Assistants. The number of students in the centre at 30.6.1953 was :—

First year	7
Second year	8
Third year	3

7 candidates entered and passed the qualifying test in December, 1952.

The aim of getting 12 suitable candidates to enter the first year class was not fulfilled.

Sanitary Overseers. There were 5 students in the centre on 30.6.1953.

Laboratory Assistants. 3 candidates passed a qualifying test. There were 2 students under training on 30.6.1953.

Laboratory assistants in the Southern Provinces were inspected by the Assistant Director (Research). He arranged a programme of refresher courses at the Stack Medical Research Laboratories for these officials.

(viii) *Nurses Training Schools.*

Malakal and Port Sudan Hospitals were recognised as competent to undertake the full three-year courses of nurses' training.

El Dueim, Kosti, Sennar, Roseires, Singa, Nahud, Dongola and the Church Missionary Society Hospital, Omdurman were added to the list of hospitals competent to undertake the elementary course of one year training for nurses.

7 male nurses and 9 female nurses were granted certificates on successful completion of a 3 year course of training.

CHAPTER IX.

LABORATORY SERVICES.

STACK MEDICAL RESEARCH LABORATORIES.

By Dr. M. A. Haseeb.

Ad hoc investigations have been carried out in connection with the effects of antibiotics on rabies, the interference of chloromycetin with the production of immunity, Q fever, leprosy, tuberculosis, vaccinia and neoplasma. Summaries of these and other research activities will be found under the appropriate headings.

Among visitors to the Laboratories were Dr. Rife of the Fullbright Foundation, Dr. R. M. Taylor and Mr. H. Hoogstraal of the United States Medical Research Unit in Cairo. Dr. Rife visited the Sudan to carry out surveys by means of blood-grouping, the phenyl-thio-carbamide taste test, anthropometric measurements and other methods. Dr. Taylor and Mr. Hoogstraal came to initiate a virus survey, primarily in connection with Q fever the causal agent of which they demonstrated in Egypt. They collected human and animal sera from various parts of the Sudan, to be tested for immunity to Q fever and several virus infections.

Dr. H. Foy and Dr. A. Kondi of the Wellcome Foundation visited the Sudan to carry out a survey of the sickle trait among the tribes of Equatoria Province.

ROUTINE AND EDUCATIONAL ACTIVITIES.

A summary of the work and examinations carried out during the period under review is appended to this report. The total number of examinations was 31,147 as compared to 24,032 in the previous year. The increase is due to various outbreaks of typhoid all over the country ; the blood cultures increased from 914 last year to 1926 this year and the Widal reaction tests from 1568 to 2659 respectively. The histo-pathological examinations rose from 703 last year to 1144 this year. This is mainly due to the activities of surgical specialists in provinces.

Owing to an epizootic of canine rabies the demands for anti-rabic vaccine were very heavy ; 316,725 mls. were issued compared to 170,250 mls. in the previous year. The issues of lymph vaccine also increased from 968,640 doses last year to 1,158,150 doses this year.

Teaching duties in the Kitchener School of Medicine and also the teaching of medico-legal subjects in the Sudan Police College have made heavy demands on the time and energy of the laboratory staff.

Hospital Laboratory Services : This year witnessed the unification and standardisation of laboratory assistants training in the whole country. The southern laboratory assistants who used to receive their training in Juba hospital now come to the Stack Laboratories at Khartoum to receive the same training as their northern colleagues.

Two laboratory assistants have completed a 3-year advanced course in bacteriology and pathology and were promoted to Scale H. They can now deal with a wide scope of laboratory techniques in serological, biochemical, histopathological and cultural methods. Five laboratory assistants were given advanced courses and instructions on the Kahn Test and promoted to Scale J. Two laboratory assistants from Equatoria Province were brought up to Khartoum for a refresher course. New hospital laboratories have been opened at Dongola, Berber and Geneina bringing the total of hospital laboratories to 33. It has been possible to second a laboratory assistant to the Professor of Medicine, Khartoum University College for special duties.

POST MORTEM EXAMINATIONS.

20 Post mortem examinations were performed in Khartoum Civil Hospital during the period under review. Of these 16 were medico-legal. The position as regards the supply of material for adequate instruction in practical morbid anatomy is still most unsatisfactory.

PATHOLOGICAL SPECIMENS.

The total was 717 excluding brains for rabies. The total for the previous year was 474.

NEOPLASMS.

171 malignant neoplasms were received of which the following table is a summary :—

Site	Carcinoma	Sarcoma	Melanoma	Mixed Tumour	Total
Scalp	4	—	—	—	4
Jaw	2	—	—	—	2
Face	2	—	—	—	2
Tongue	2	—	—	—	2
Mouth	3	1	—	—	4
Eye	8	2	—	—	10
Neck	2	—	—	—	2
Thyroid	4	—	—	—	4
Parotid	—	—	—	10	10
Chest-Bronchus	1	—	—	—	1
Shoulder	—	1	—	—	1
Arm	2	1	—	—	3
Back	1	—	—	—	1
Leg	8	5	1	—	14
Foot	2	—	9	—	11
Buttock	—	1	—	—	1
Rectum, anal canal	7	—	—	—	7
Abdomen	5	2	—	—	7
Mesentry	1	—	—	—	1
Liver	4	—	—	—	4
Bladder	8	—	—	—	8
Kidney	1	—	—	—	1
Groin	1	1	—	—	2
Penis	3	—	—	—	3
Prostate	2	—	—	—	2
Overy	2	—	—	—	2
Uterus	6	—	—	—	6
Cervix	4	—	—	—	4
Breast	22	—	—	—	22
Lymph gland	9	2	—	—	11
Skin	11	1	—	—	12
Site unspecified	4	2	—	—	6
Bone	—	1	—	—	1
TOTAL	131	20	10	10	171

Dr. J. D. Bates comments on these neoplasms as follows :—

" The solitary case of carcinoma of the bronchus was discovered in a European who died in transit by air through the Sudan. Among Sudanese such tumours are conspicuous by their absence. The primary carcinomas of the liver were all discovered or confirmed by post mortem examination. All cases were in males aged about 30-35 who also had obvious cirrhotic changes in the liver. Two cases presented clinically as intraperitoneal haemorrhage.

No evidence of bilharzial infection could be found in the carcinomas of the bladder. As all specimens were, however, obtained as cystoscopic biopsies the chance of a complete study of the tumour and bladder was ruled out. Of the melanomas eight occurred in the sole of the foot, the usual distribution of the tumours in this country. The ages of the patients with retinoblastomas was 4, 3, and 6 years. In all cases the typical histological pattern was seen. One case seen clinically showed signs of bilateral involvement of the eyes.

Four cases of malignant tumours in very young children were seen. Two of the fibrosarcomas reported coming from children under two ; one was in the foot and the other was a retro-orbital tumour. Two of the anaplastic malignant tumours also came from young children. In both cases abdominal masses were present and it was suspected they might be neuroblastomas as in one case secondary growths were present in the maxilla. However no post mortem examination was permitted in either case, and the biopsy specimens examined showed small round cells but no fibrils or rosettes.

RABIES.

454 brains were received of which 27 were badly decomposed and useless for examination. 148 of the remaining 427 were positive for Negri bodies. The species of distribution of positive brains is shown in the following :—

Animal Species	Positive
Dog	110
Donkey	13
Cat	5
Horse	2
Calf	3
Fox	—
Sheep	2
Goat	9
Bull	1
Cow	2
Camel	1
Mongoose	—
Monkey	—
TOTAL	148

Antibiotics in Rabies.

An investigation of the value of terramycin in the treatment of experimental rabies in mice was completed and the results were published, (M. A. Haseeb, *Nature* (1952) 170,983). Like all the drugs and antibiotics previously tested in these laboratories terramycin was found to have no influence on the course of the infection.

An epizootic of rabies occurred among the dog population in the Province. It started in October with 6 positive cases and reached its peak in December 1952 with 16 positive brains. The animals infected were mainly dogs, but infection in cats, donkeys, horses and cows also occurred. Advantage was taken of this epizootic for trying the smear method for diagnosis of rabies and smears were taken from brains before fixation in formalin. The smear was fixed by methyl alcohol and stained by dilute Lepine stain. It was found that in all cases where the section was positive the smear was also positive. It is concluded that the smear method is very useful in giving a provisional diagnosis where urgent treatment is indicated, but it is felt that it should be confirmed by the section method.

For the control of the epizootic a very large number of stray dogs was shot and vaccination of the registered dogs was made compulsory. The "Flurry strain" vaccine was used.

Rabies vaccine : 316,725 ml. were issued this year compared to 170,250 ml. issued last year. The quantity of vaccine issued this year was sufficient to treat 4,524 persons.

LYMPH VACCINE.

Research : A series of comparative potency titrations of lymph vaccine were carried out on various animals. The purpose of this investigation is to find out the relative sensitivity of these animals to the same vaccine. The animals used included unvaccinated babies, calves, sheep and rabbits. Several experiments were carried out and the results showed that man is the most resistant and the rabbit most sensitive in the series. Furthermore the results showed that the endpoints of titration of the same vaccine on man, calf, sheep and rabbit are 1 : 10, 1 : 100 and 1 : 1000 respectively.

The value of this investigation is two-fold. Firstly it throws light on the potency of the vaccine to be used for routine vaccination, and secondly it allows workers in vaccine preparation a wide choice of the animal to be used in titrating lymph vaccine potency. Rabbits, the usual experimental animals, may sometimes for unknown reasons become resistant and therefore unsuitable for use. On such occasions sheep can be used with advantage.

Routine : 99 sheep were used for the production of 5047 mgms of pulp with average yield of 51 grams per sheep.

SCHISTOSOMIASIS.

The formation of a bilharzia research unit has been hampered by the difficulties of recruiting suitable staff but Mr. Markowski, the fresh-water biologist, has already made some interesting observations on the distribution of snails in the irrigated system of the Gezira. His preliminary experiments indicate that the ordinary method of snail destruction by molluscicides can be rendered much more effective if combined with a system of trapping at selected points.

The period under review has seen the publication of two important papers on schistosomiasis by Dr. Greany (Ann. Trop. Med. and Parasit., 46 pp. 250-267 and pp. 298-310). These provide an authoritative, up to date account of the problems of schistosomiasis in the Gezira Irrigated Area of the Sudan. Among other things Dr. Greany reports his experiences in *S. mansoni* infections with intradermal tests using the adult worm antigen prepared in these laboratories and mentioned in previous reports (1949, 1951). The results are compared with those obtained by using a cercarial antigen in the same way and also with those of faecal examination. Dr. Greany concludes that the intradermal tests are less reliable as a method of diagnosis than faecal examination. His experiences with Nilodin (Miracil D) in treatment confirm the rather disappointing results previously obtained by the present writer (M. A. Haseeb, B.M.J. (1952) 1,1331).

Q FEVER.

In a paper signalizing the occurrence Q fever in Egypt Taylor et al (1952, J. Egypt Pub. Health Ass., 27, 123-128) reported that they had recovered the causal agent *Coxiella burneti* from a suspension of 12 specimens of *Hyalomma excavatum* collected at the Cairo Municipal Abattoir from bulls imported from the Sudan.

This suggested the possibility of the infection being present in the Sudan as well as in Egypt, although the exact provenance of the ticks was uncertain. Human and animal sera from various parts of the Sudan have been collected and tested for complement fixing anti-bodies to Q fever by Dr. R. H. Taylor at the United States Naval Medical Research Unit at Cairo. He found that only 7 sera among the 85 collected in Khartoum gave a positive complement fixation with Q fever antigen and this only in a low dilution of 1/8. It would appear, therefore, that Q fever is not a common infection in Khartoum area.

He found a somewhat higher percentage of positives in sera collected in Kelaya and Gilo near Torit, but since these sera were partially anti-complementary, one feels hesitant in interpreting the results. He believes that there is indication that Q fever is present in this region. Dr. Taylor comments that it can be said with confidence that compared to Q fever infections in Egypt, the rate in the Sudan, particularily around Khartoum, is very much lower and indeed one may question if Q fever infection exists to any extent in the latter region.

A survey for the presence of Q fever in the Sudan was also started by the present writer and so far sera from sixty Sudan sheep were collected and tested by the complement-fixation method with negative results. The writer is indebted to Dr. Taylor for the supply of Q fever antigen and ambo-ceptor. The survey is continued.

WEST NILE VIRUS.

Human sera from various parts of the Southern Sudan were collected by Dr. Taylor and neutralisation tests with West Nile virus were carried out. The results of these tests are tabulated below :—

Results of West Nile Neutralization tests :

Incidence by locality.

Locality	No tested	Negative	Inc.	Positive	Pos. %
Torit	34	25	1	8	24%
Keyla	45	38	1	6	13%
Gilo	41	28	—	13	32%
Katire	41	35	1	5	12%
Juba	41	17	1	23	56%
Ganzi	41	24	2	15	36%
Yei	40	33	2	5	13%
Malakal	42	2	7	33	79%
Wau	33	4	—	29	88%
TOTAL	358	206	15	137	38%

Incidence by age

Age Groups	No. tested	Negative	Inc.	Positive	Pos. %
5 — 9 years	83	61	3	19	23%
10—19 ,, ...	110	74	5	31	28%
20—29 ,, ...	93	38	3	52	56%
30 ,, ...	72	33	4	35	49%
TOTAL ...	358	206	15	137	38%

It will be noted that positive reactions were found in all places sampled and the incidence was particularily high in the neighbourhood of Juba, Malakal and Wau.

Sera from 5 to 6 baboons that were collected in the Wau region also neutralized West Nile Virus, suggesting that infection may exist among the primates of this region.

POLIOMYELITIS.

Clinical observations indicate that this infection shows seasonal activity among young children in Khartoum and Omdurman. The work of Dr. Townsend-Coles and the late Dr. G. M. Findlay on the effect of intramuscular injections, mentioned in the last report has now been published (Trans. Roy. Trop. Med. and Hyg., 47,77). The survey in Upper Nile Province, mentioned in the last report has shown that all individual sera tested and all pools neutralised Lansing virus in significant amounts, but the results with Brunhilde and Leon Viruses are not yet available. All the donors were young adults. The results suggest that Poliomyelitis is endemic in the Sudan.

ENTERIC INFECTIONS.

During the year several outbreaks of enteric fever occurred in various parts of the country. A comparatively big outbreak occurred in Omdurman in the months of December, January and February. As chloromycetin was used on a fairly large scale in treatment, opportunity was taken of this to investigate whether the antibiotic interferes with the development of immunity which is expected as a result of the infection. Sera were collected from hospital in-patients before and again after a course of chloromycetin and tested by the Widal agglutination method. Sera from untreated cases were taken as controls. The result of the agglutination tests on 25 treated cases indicate that there is a significant interference with the formation of anti-bodies. This is of course in accordance with the experience of Lt.-Col. Sachs, Director of Pathology, British Forces, Middle East, who in 1952 treated more than 300 cases of typhoid by chloromycetin in a military hospital and found that in some cases the infection might be completely extirpated without the usual development of immunity. A series of small doses of T.A.B. vaccine was recommended by him for building up immunity after treatment with chloromycetin. (Medical Progress (1952), British Encyclopedia of Medical Practice, III).

An Unusual Enteric Infection.

An unusual enteric infection was encountered in a case of a cyst of the ovary. The patient ran a continuous temperature for more than two months. The abdomen was distended and on tapping a thick jelly-like fluid was obtained. On culture *Salm. typhosum para A* was isolated in a pure form. Blood cultures on several occasions remained sterile and no pathogenic organisms were isolated from faeces or urine. The patient responded to treatment with chloromycetin. The cyst of the ovary was removed by laporatomy and complete recovery followed.

A rapid screening test for use in the bacteriological examination of faeces.

In the course of an investigation into the frequency of the occurrence of *Salmonella* in faeces Pro. J. C. Cruickshank of London School of Hygiene and Tropical Medicine (1949) concluded that a test which would rapidly identify those colonies appearing on Leifson's agar plates as being Urease-positive and/or indol-positive would be of great value.

Such a test was devised by his collaborator Williams Smith in the same year and was referred to as the I.U. Test. The substrace is a solution of 0.1 percent tryptophan and 0.1. per cent urea in Clark and Lub's phosphate buffer, pH 7.2. As this test is simple and can be completed in three hours its use as screening test saves both time and media in the detection of *Salmonella*. Experiments were carried out in the Stack Laboratories to assay the value of this test in the routine examination of faeces and urine for typhoids and faeces for dysentries. The results show that at least 60 per cent of the suspicious non-lactose fermenting colonies which are seen on Leifson's agar plates can be discarded by this test and that at least in 32 per cent of cases the bacteriological report can be sent 24 hours earlier, saving a large amount of media and also time of the laboratory staff and it should also be of value in saving hospital bed time.

ENDEMIC FLUOROSIS.

In December 1952 Professors Dean Smith, Harris and Kirk visited Abu Deleig in the Butana under the auspices of the Ministry of Health to follow up observations on nutrition made there by Dr. N. L. Corkill (1934 and 1950). During the examination of Abu Deleig school-boys, aged 7 to 14 years, many instances of abnormality of the dental enamel, characteristic of fluorosis, were observed. The changes were :—

Grade 1. White opaque chalky areas of the enamel of permanent teeth, most commonly seen on the cusps of premolars and first molars and the distal half of the central and lateral incisors.

Grade 2. Dark yellow-brown discoloration, often in a pattern of broad horizontal bands or wavy parallel lines, most prominent in the incisors.

Grade 3. Pitting, with mottled discoloration, mostly of the incisors.

Water samples from the wells which provide drinking water were analysed in the Wellcome Chemical Laboratories and found to have fluorine concentration of 1.1 to 4.0 parts per million, concentrations likely to produce dental fluorosis of the prevelance and severity observed. The observations have been published separately as fluorosis has not hitherto been recorded in the Sudan. Subsequently occasional well waters in different parts of the Sudan have been found to have similar high concentrations of fluorine, so it is possible that fluorosis may be quite widely distributed.

RETICULO-ENDOTHELIAL CYTOMYCOSIS

This term is here used for the condition described in previous reports as histoplasmosis, visceral torulosis, blastomycosis etc. to indicate merely fungus-like bodies observed inside cells of the reticulo-endothelial system, usually lymphoid tissue. A further nine instances of this condition have been observed, all in the appendix, but the aetiological relation of the fungus-like bodies to the signs and symptoms has not been established. Histologically the condition resembles histoplasmosis, but the parasites are comparatively scanty, no fatal or clinically typical cases have been observed and exact diagnosis must await isolation of the causal organism. This has not yet been possible. The condition has been recognised only by the examination of paraffin sections, usually of tissues submitted to the Laboratories for histological report.

TUBERCULOSIS.

Routine : The culturing of pathological materials for purpose of diagnosis of tuberculosis has been adopted as a routine procedure. The medium used is Lowenstein's. So far eighty sputa were cultured and in eight instances *Myco. tuberculosis* was isolated.

Research : Surgical tuberculosis in the form of tubercular adenitis of the neck and groins, hip-joint and Pott's disease is fairly common in the Sudan.

According to Veterinary workers bovine tuberculosis is so rare that they only come across one case every ten years or so. Their main evidence is the absence of tuberculous lesions in carcasses slaughtered in abattoirs which are regularly examined by the Veterinarians.

Fifteen strains of *Myco tuberculosis* were isolated from various materials cultured on serum agar media. Twelve specimens were cervical glands, two were glands of the groins and one specimen came from a case of Pott's disease. All the cases were Arabs of the northern Provinces who came from various towns to seek treatment in Khartoum, Khartoum North or Omdurman Hospitals. The fifteen strains were typed by growing them in various culture media with and without glycerine and also by animal inoculation into guinea-pigs and rabbits. All the fifteen strains proved to belong to the human type of *Myco tuberculosis*. The investigations are being continued.

BLOOD.

As mentioned in the 1949 report blood specimens have been collected from northern Sudan for typing by Dr. A. C. Mourant and his colleagues in the Blood Group Reference Laboratory, London. Determinations have been made of the ABO, *RH* and MNS blood groups of hospital patients at Khartoum and Omdurman and the results have now been published. The *RH* gene frequencies suggest that these northern Sudanese originated from mixing of Mediterranean and Negro populations (Brooks *et all* 1952).

In a survey for sickle cell anaemia in Africa Dr. Henry Foy and Dr. Athene Kondi visited the southern Sudan and carried out investigations among the local tribes. Although their findings in general indicate that the percentage of the sickling trait is not high, the final results of their investigations are not yet to hand.

Dr. Rifle of the Fullbright Foundation, United States, visited the Sudan and obtained data from approximately 600 Sudanese. About 3/4 of them were from the southern Provinces and the remainder from northern Provinces. The southern Sudanese included 340 Nilotics (Shilluks, Dinkas, Nuers), and 74 Bari from the region around Juba in the far south. The data included the ABO Blood groups, ability to taste phenyl-thio-carbamide, etc.

His results are summarised as follows :—

Blood Group Distributions.

Population	Number	O	A	B	AB
Shilluk	90	53.3%	20.0%	22.2%	4.5%
Nuer	100	51.0%	28.0%	18.0%	3.0%
Dinka	123	50.5%	30.0%	15.5%	4.0%
Total Southern Sudanese	313	51.6%	26.6%	18.3%	3.5%
Sudanese soldiers—mostly Northern	4,370	45.4%	27.8%	22.2%	4.5%
Congo Negroes	500	46.0%	22.0%	24.0%	8.0%
Egyptian soldiers	10,045	32.6%	35.4%	24.3%	7.7%

Comparisons of the above data reveal highly significant differences between Sudanese and Egyptians. Northern Sudanese, Southern Sudanese, and Congo Negroes also differ from each other, but not so extensively.

PUBLICATIONS.

The following papers have been published by the laboratories staff or accepted for publication during the period under review.

Brooks, P. J., Garner, K. E., Ikin E. W., Mourant A. E., and Drysdale, A. I. (1952). The blood groups of the Northern Sudanese. *Annals of Eugenics*, 17, 75-78.

Bayoumi, A. and Haseeb, M. A. (1953). Report of a case of non-parasitic solitary cyst of the spleen. *Sudan Med. J.*, I, 30-33.

Haseeb, M. A. (1953). The use of phenol for the purification of vaccine lymph. *Sudan Med. J.*, I, 26-29.

Haseeb, M. A. (1952). Terramycin in the treatment of experimental rabies in mice. *Nature*, 6th December, 1952.

Kirk, R. (1953). Notes on yellow fever. *Sudan Notes and Records*, 33, (in the press).

Kirk, R. (9953). Recent advances in Tropical Medicine. V. Yellow Fever. *West Afr. Med. J.*, 2, (in the press).

Kirk, R. and Lewis, D. J., (1952). Some Ethiopian Phlebotominae. *Ann. Trop. Med. and Parasit.*, 46, 337-350.

Kirk, R. and Lewis, D. J. (1953). Taxonomy of the Ethiopian sandflies (Phlebotomus). V. on *Phlebotomus africanus* Newstead 1912. *Ann. Trop. Med. and Parasitol.*, 47, (in the press).

Smith, D. A., Harris, H. A. and Kirk, R. (1953). Fluorosis in the Butana, Sudan. *J. Trop. Med. and Hyg.*, 56, 57-58.

Summary of Routine Examinations.

Kahn Tests	14,114
Widal reactions	2,659
Weil Felix reactions	3
Heterophile agglutination tests (Paul-Bunnell)	11
Blood cultures	1,926
Blood films	1,693
Blood counts	69
Cerebrospinal fluids	120
Medico-legal specimens (blood and seminal stains)	52
Biochemical tests	504
Autogenous vaccines	5
Pathological histology (including brains for rabies)	1,144
Faeces	3,524
Urines	2,389
Throat and nasal swabs for *C. diphtherise* positive	117
Throat and nasal swabs for *C. diphtherise* negative	1,806
Sputa for *Myco. tuberculosis.* positive	8
,, ,, ,, ,, negative	72
General bacteriological examinations	833
Water tests	98
TOTAL EXAMINATIONS	31,147

Summary of Faeces Examination.

Shigella flexneri, V—Z types	101
Shigella Shigae	34
Shigella Schmitz	18
Salm typhi	132
Salm paratyphii A	2
Salm paratyphii B	1
Entamoeba histolytica	13
Ova present	17
Negative	3,206

Summary of Urine Examinations.

Salm, typhi	29
Salm paratyphii A	2
Ova present	11
Negative	2,347

Summary of Kahn Tests.

Positive	3,169
Negative	10,945

Summary of Blood Films.

Benign tertian malaria	6
Subtertian malaria	243
Negative	1,444

Summary of Widal Reactions.

Salm typhi	503
Salm paratyphi A	3
Salm paratyphi B	3
Br. melitensis	77
Negative	2,073

Summary of Blood Cultures.

Salm typhi isolated	289
Salm paratyphi A isolated	33
Br. melitensis isolated	6
Streptococcus pyogenes isolated	25
Other organisms isolated	28
Negative	1,550

Summary of Heterophile Agglutination Tests.

Positive	2
Negative	9

Summary of Weil-Felix Reactions.

Negative	3

Summary of Vaccines Issued.

A.R. vaccine	316,725	ml.
T.A.B. vaccine	63,100	ml.
Cholera vaccine	51,300	ml.
Streptococcus aureus	625	ml.
Lymph vaccine	1,158,150	doses.

WELLCOME CHEMICAL LABORATORIES.

By Mr. D. N. Grindley.

During the period under review the number of samples examined was 1473 as compared with 1736 for the previous twelve months, and 1142 for the corresponding antepenultimate period. The drop in the number of samples compared with the previous twelve months is entirely accounted for by a reduction in the number of samples of gum arabic submitted by the Silviculturist, Research Division, the number of other samples showing an increase, particularly the number of potable waters examined, which has increased by nearly fifty per cent. The period under review opened with an acute staff shortage, which is now substantially improved. There is a tendency for considerably more complete examinations to be called for on individual samples than was previously the case, and the consultative work has also shown an increase. Much time has been spent on the introduction of new methods of analysis and training the staff in the necessary manipulation.

The general distribution of samples amongst the various categories is very similar to that of recent years, and again a high proportion of the work is of a medical or semi-medical nature. Work for private firms is being maintained at a high level, and is likely to show still further increase as the industry of the country develops and new industrial processes are initiated.

The research work has consisted of a continuation of the investigation into the probable cause of stringiness in gum arabic ; the action of rectified spirit on galvanised iron drums, the incidence of dental fluorosis, work on the preservation of fruit-juices, an extension of the work on nimitti reported last year, examination of plant materials for essential oils suitable for the perfumery industry and a revival of the work done on the production of medicinal sulphates from sea-water that was initiated in the early years of the War.

The work of the fatty acid composition of seed-oils has been extended, and an investigation into the properties, method of estimation and preparation of stearolic acid has been commenced. A new method for the determination of the quantitative absorption of bromine by fats has been described, and work is in progress on the devising of a reliable method for the analysis of minor constituents occurring in ferruginous ores.

During the period under review one original paper and the Report of the Government Analyst for 1.7.51—30.6.52 were published or prepared for publication.

The routine samples examined were classified as follows, the corresponding figures for the previous twelve months being given :—

	1.7.1952 to 30.6.1953	1.7.1951 to 30.6.1952
Waters	161	134
Foodstuffs	215	200
Medico-Legal and miscellaneous drugs	146	162
Mineralogical	117	120
Miscellaneous	834	1,099

ROUTINE WORK.

Waters.

The majority of the samples submitted were received from the Geological Survey, mainly from new bores and wells. It is anticipated that this work will increase still further in the near future, as the extensive well-boring programme is implemented. As a matter of routine, all samples of water are now analysed for fluorine content, following the discovery of chronic dental fluorosis in certain areas in this country. Of the one hundred and sixty one samples submitted, one hundred and fifty three were classified as potable waters, and the reminder as boiler waters.

Foodstuffs.

Under this heading are included milk samples, taken by the Public Health Sections, suspected of adulteration, alcoholic beverages, grains and flours, butter fats and various vegetable oils examined for suitability for human consumption. A variety of miscellaneous food-stuffs, including samples of cane-sugars, fruit squashes and others have also been submitted for analysis.

Medico-legal and miscellaneous drugs.

Under this heading are included pathological specimens (43), toxicological (53) and miscellaneous drugs (50). Of the first, the majority were ante-or post-mortem specimens concerned with fourteen separate cases of suspected poisoning, in six of which the findings were positive, two being due to arsenic. Deaths of cattle from arsenical poisoning still occur fairly frequently, probably as a result of ingestion of poisoned bran used as locust bait. In addition to the above, six samples of blood were received for calcium, proteins.and uric acid, various stools for split and unsplit fat, also samples of urine and human milk.

Among the toxicological samples submitted several specimens of plant material were shown to contain hashish, including the contents of a cigarette, three samples of suspected drugs were shown to be opium, and a root from Equatoria Province connected with a case of poisoning was shown to contain colchicine, this being the first case of colchicine poisoning on record in this country. Several samples of water from the Gezira canals were examined for copper content in connection with the campaign against bilharzia, and as in recent years household utensils have been submitted by the Sudan Customs for examination for the presence of lead, in the coating of one of which it was present to the extent of 71 per cent. The Research Division, Ministry of Agriculture continue to submit samples of Abavit B for control purposes.

The miscellaneous drugs include a wide range of samples, many of which were tested for conformity to B.P. Standards. Ampoules of quinine hydrochloride have been examined from time to time for the Medical Stores to observe if any progressive deterioration occurs when these are held in stock over a prolonged period. A document submitted by the Police was shown to have had parts of the original writing erased and altered. Samples of various industrial chemicals, including fertilizers and battery sulphuric acid were analysed. An unknown substance was identified as codeine, and a sample of methyl methacrylate resin for dental purposes was shown to have been heavily adulterated. The laboratories were consulted on the disposal of large stocks of cyanide, which was successfully rendered innocuous.

Mineralogical.

Included in this category are thirty four samples of coal, seven samples of mineral oil, four of the latter being examined in connection with a case of suspected sabotage ; and twenty eight samples of white metals and several brazing metals and copper submitted principally by the Sudan Railways. In addition, regular samples of salt have been received from the Sudan Salt Co., and a wide variety of minerals, mainly containing iron, titanium and manganese have been analysed for the Geological Survey. Also, twenty six samples of building materials of various kinds have been examined for the Public Works Department in connection with the mechanical failure of the foundations of a local building.

Miscellaneous.

One hundred samples of oil-cakes, principally cottonseed and sesame, were received mainly from private firms, but also from the Research Division, Ministry of Agriculture and from the Jonglei Investigation Team, and in addition an increasing number of oil-bearing seeds, cottonseed 143, sesame 59, groundnuts 3, castorseeds 32, *Hyptis spicigera*, *Lageneria vulgaris* 1 and *Balanites aegyptica* 1. Sixty nine samples of methylated spirits have been examined for the Sudan Customs. Seventy one samples of various kinds, but mainly cloth and wrapping paper have been examined to ascertain the cause of spoilage, mainly in connection with maritime insurance claims.

Twelve samples of soap were received, mainly from local manufacturers, the quality of which still varies very much indeed, and three hundred and thirty two samples of gum arabic have been examined, mainly in an endeavour to trace the cause of stringiness which occasionally manifest itself in this product. Other samples included in this category include plant materials which were distilled for essential oils and various waste plant by products which were analysed with a view to finding a use for them in industry.

INVESTIGATIONS.

Gum Arabic.

This work was undertaken to try to find the cause of stringiness that occasionally appears in gum samples. Consideration of the results obtained during the examination of several hundred samples of gum arabic collected from various localities at different times of the year, and from trees of varying ages growing under different conditions of soil and climate have brought to light several interesting trends. Stringiness definitely decreases in the later part of the season, after the end of January. The total amount of stringy gum represents only a very small proportion of the whole crop, but quite a small quantity of this may ruin large parcels of satisfactory gum. Trees producing large quantities of gum usually gave a product more satisfactory than those only producing small quantities. There was no correlation between stringiness and size of trees, and frequently although first samples from a given tree were stringy, second samples were not so, and *vice versa*. Some old and very large trees were still producing gum of good quality.

Action of rectified spirit on galvanised iron drums.

It has been observed that rectified spirit, when stored for a prolonged period in galvanised iron drums, frequently becomes turbid, due to action on zinc lining. Quite heavy suspensions of zinc oxide have been encountered in rectified spirit so stored, which give rise to frequent complaints from pharmacies and hospitals. It is recommended that mild steel drums be used for storing this liquid, and that the storage time be limited to one year.

Fluorosis.

Many samples of water have been examined in connection with an investigation carried out by the teaching staff of the Kitchener School of Medicine into the nutritional status of the villagers of Abu Deleig. The fluorine content of these waters varied from 0,65 to 4.0 p.p.m., and it was observed that there was an incidence of dental fluorosis amongst the children of the area amounting to 61 per cent of the total. The population seemed very free from dental caries. As a result of this investigation, all water samples received by the laboratories are now examined for fluorine content, and where this is shown to exceed 1 p.p.m. the medical authorities are notified, for although dental fluorosis is not in itself of particular importance, it may be indicative of very much more serious metabolic disorders or of chronic poisoning.

Nimitti.

An extension of the work published last year on the composition of nimitti has been undertaken, the mineral constituents now having been determined in detail. The total ash was shown to contain 35 per cent of P_2O_5, 24 per cent of SiO_2 and 16 per cent of K_2O, and it is pointed out that the continued emergence of these insects from the river represents a big drain not only on the nitrogen reserves of the river, but also on the phosphorus and other nutrient constituents.

Essential Oils.

Several locally occurring plant materials have been steam-distilled for the presence of essential oils likely to be suitable materials for the perfumery industry, and two that are worthy of note are (a) the flower-heads of *Ocimum basilicum,* which yielded 2 per cent of an oil said to consist mainly of methyl chavicol, and (b) the rhizomes of *Cyperus rotundus*, which after milling gave a very pleasant volatile oil having an odour reminiscent of ginger, but the yield was rather poor.

Production of sulphates from sea-water.

The work which was initiated in the laboratories in 1940 with a view to producing medicinally valuable sulphates from the bitterns remaining in the salt pans at Port Sudan after the crystallisation of common salt was started up again, and two visits have been paid to the salt works, where semi-large scale experiments are now in progress. The principal difficulty appears to be the removal of contaminating mother-liquor from the final product before it dries out and so avoiding the introduction of undesirable potassium salts. This is to a certain extent aggravated by the deposition, at this stage, of magnesium hydroxide in a slimy form which renders filtration very difficult, and it is suggested that this be corrected by the addition of the requisite amount of sulphuric acid to neutralise the liquor at the beginning of the stage which produces the required crop of crystals. The onset of this stage is indicated by observing the specific gravity of the liquor as evaporation proceeds. Centrifuging the final product also seems most desirable.

Vegetable oils and oil-seeds.

Attempts to obtain further information regarding the effect of temperature on the fatty acid compositions of seed oils were unsuccessful, as the various crops selected for this investigation all perished when grown under conditions vastly differing from those of their natural habitat. However, it is hoped to persevere with this investigation under less vigorous climatic conditions.

The survey of seed oils has been further extended to include the species *Rubus chamaemorus*, and also the seeds of *Clitoria ternata,* a plant which has been introduced into the Gezira area, has been exhaustively examined with a view to its use as a human food-stuff. The seeds are very rich in protein and appear to be free from toxic principles, although there is certain evidence that the latter are present in the roots.

Preservation of fruit juices.

A series of experiments have been conducted with a view to preserving the large quantities of mango, citrus, tomato, melon and other fruit juices which this country is potentially capable of producing. Benzoates have proved to be valueless for this purpose, and work has now been devoted solely to the use of sulphur dioxide, which is the only other preservative permitted by the United Kingdom food regulations to be present in fruit-juices. This is added in the form of potassium metabisulphite, which is very efficacious in the case of citrus and mango juice, although the latter requires a rather heavier dosage than would be permitted by the British food regulations. Tomato juice was shown to be capable of being preserved by this compound, but unless sterilization was first resorted to, the dosage required was more than could be permitted. Experiments with melon juice were unsuccessful, probably owing to the presence of proteolytic enzymes in this fruit. In all cases so far examined, the natural acidity of the fruit juice was sufficient to liberate the sulphur dioxide from the metabisulphite without requiring to be artificially supplemented. Great care was shown to be necessary to ensure homogeneous mixing of the product, but excessive agitation, which causes sulphur dioxide to be lost, should be avoided. Air-spaces above the product after sealing should also be reduced to a minimum for the same reason.

Stearolic acid.

Considerable work has been carried out on the preparation, properties and estimation of stearolic acid, all the earlier work on this subject having been exhaustively reviewed and some of it found to be contradictory. Acetylenic acids are known to occur in the seed fats of certain species, and it is desirable that they should be recognised when present. With this end in view, samples of high quality oleic and elaidic acids were prepared from Olive oil, and were converted by bromination into the respective isomeric dibromostearic acids. These were then subjected to dehydrobromination by the action of amyl alcoholic potash, and there is reason to believe that although stearolic acid is produced in good yield from the dibromo-derivative from oleic acid, that from elaidic acid reacts in a different way, producing what is probably the conjugated 8 : 10 octadecadienoic acid. This interesting piece of work will be continued as opportunity permits.

Several rather abnormal properties of stearolic acid have been investigated, in particular the reactions with thiocyanogen, iodine monochloride and bromine.

A modified procedure for the quantitative determination of bromine absorption of oils and fats.

This investigation has been reported more fully elsewhere (Analyst, 1953, in the press). The purpose of this was to evolve a simple method of measuring total unsaturation in mixtures of fatty acids when acetylenic and/or conjugated acids were present. The Toms method was shown to suffer certain minor disadvantages, which have been largely overcome, and the modified procedure has been employed in conjunction with the Wijs method to give an approximate estimate of the amount of stearolic acid when in admixture with other fatty acids.

A new analytical method for the estimation of minor constituents present in ferruginous minerals.

It was desired to devise a method suitable for the routine examination of samples of iron-stone which are being submitted for analysis, with special reference to the estimation of any manganese, titanium, chromium or vanadium that might be present. Considerable work has already been done, but so far it is not yet complete. Great promise is shown by the use of organic solvents for the separation of the constituents, the iron being extracted by either as ferric chloride from 6N hydrochloric acid solution, and the chromium being separated by either extraction after conversion to " perchromic acid " by the action of hydrogen peroxide on the cold solution of chromate. Manganese is estimated colorimetrically by periodate after oxidising the solution with potassium bromate, which precipitates this metal as manganese dioxide. The action of hydrogen peroxide on titanium and vanadium produces in each case a reddish-brown colour which is not extractable with ether, that derived from titanium alone being destroyed by hydrofluoric acid. Work is in progress on the adaption of colorimetric techniques to the possibility of making use of these reactions for the quantitative estimation of titanium and vanadium in minerals of the type under consideration, and it is hoped to test out the suggested method thoroughly on known mixtures in the near future.

MEDICAL ENTOMOLOGY.

By Mr. D. J. Lewis.

IDENTIFICATIONS.

In 66 collections, received from many parts of the country, 812 specimens of insects and other animals were identified. Three other collections contained some 3,500 specimens, mainly *Tanytarsus lewisi.*

Insects from aeroplanes were as follows :—Port Sudan, 22.8.52 from Jedda, *Wohlfahrtia* sp., 2, *Bengalia* sp., 1, Wadi Seidna, September, from Entebbe, *Taeniorhynchus fuscopennatus* Theobald. The latter is a common biting species at Entebbe but is unknown in the Sudan.

No specimens were received from cases of human myiasis but *Wohlfahrtia nuba* Wied. and *Lucilia pulchra* Wied. were identified from lesions in a horse and a fowl respectively.

INSECTICIDES AND REPELLENTS.

Diesel oil and waste garage oil, impregnated with D.D.T. were tested and found to be satisfactory for use against larvae of *Anopheles gambiae* in the Gezira. These oils have now largely superseded proprietary oil. Bricks of benzene hexachloride and plaster of Paris were used in some irrigation channels but did not prove effective.

Numerous tests of space sprays were made with *Musca domestica vicina* from the laboratory colony, mainly for the Controller of Medical Stores, with the object of checking the quality of official spray insecticides often of necessity transported and stored under unfavourable conditions of high temperature. A local modification of the Peat-Grady test method was adopted ; a " Microsol " revolving disc sprayer was used in a ten-cubic metre room, and knocked-down flies were collected with an adapted vacuum machine for transfer to recovery jars.

Test of residual insecticides were made chiefly to examine the apparent resistance to B.H.C. in house-flies at Omdurman.

An additional use for dimethyl phthalate repellent is suggested by the work of Hunter and others (1952, Trans. R. Soc. trop. Med. Hyg. 46, 201-206) who tested protective substances against a species of schistosome.

EDUCATIONAL AND ADVISORY WORK.

A practical class was held for 17 sanitary overseers from the School of Hygiene and mosquito men and other public health staff received training, and many students and other visitors were shown demonstrations of insects. A lecture on *Tabanidae* was delivered to the Sudan Veterinary Association.

Specimens were supplied to the Bakht er Ruda Institute of Education, the Khartoum Graphic Museum, the Khartoum University College, the Kitchener School of Medicine and the School of Hygiene, and to institutions in Britain, Mauritius and the United States.

Advice was given to enquiries from various parts of the country.

to hundreds of millions. *T. lewisi*, in addition to its effect on human beings, caused trouble this year by spoiling new paint on steamers at the dock yard. Grindley (1952, J., exp. Biol., 29, 440) has studied the chemistry of the fat body in this species. Large scale oiling experiments were carried out at night in collaboration with the Senior Public Health Inspector. Large numbers of midges were killed but many reached the shore, possibly owing to the difficulty of laying a complete oil film in darkness and with a variable wind. Observations at Wad Medani showed that chemical insecticides were more likely to be effective against larvae than pupae, and that food particles ingested by the larvae were very small, usually much less than ten microns across. It follows that insecticides applied from a boat and designed to sink to the bed of the river will be too coarse for ingestion and, to be effective, will have to act indirectly.

A large reddish species, *Nilodorum brevibucca* Kieffer, which usually appears in small numbers in March and is often mistaken for mosquitoes, was unusually abundant at Khartoum and caused much annoyance at Khartoum North. It emerges in the evening, unlike *T. lewisi* and oiling at this time was followed by very favourable report by residents near the river.

CERATOPOGONIDAE.

Biting midges were received from Rumbek where they were attacking hawk-moth caterpillars.

SIMULIIDAE.

Simulium damnosum. It has not yet been possible to control the breeding of this species in the southern Sudan because the areas mainly affected by onchocerciasis are sparsely populated and the rivers large. Adequate control may never be practicable, but the findings of Fredeen and others (1953, Nature, p. 700) on the effect of silt suggest that some local control might be feasible with adequate staff and funds.

Simulium griseicolle. A request for help in the grey nimitti problem was received from the Dongola Rural Council. Control is extremely difficult, if not quite impracticable, owing to the size of the Nile in which the larvae live. Observations were carried out, however, at Wad Medani, on the time of emergence in the hope that oil might serve to prevent this process. Altogether 298 emerging adults were caught in a specially designed trap at three-hourly intervals in two 24 hours catches. The percentage totals at the end of each period were as follows

02.30	05.30	08.30	11.30	14.30	17.30	20.30	23.30
1	5. 7	49. 4	11	7. 7	20	3	2

Eighty-eight per cent emerged by day, and there were two peak periods, confirmed by further catches, at about 09.00 and 15.00 hours. Tests with submerged oiling apparatus indicated that oiling might have some value if the breeding were very limited.

Arrangements were made to survey breeding sites and to test citronella oil as an oil factory repellent and other protective devices at Dongola in February, but the season was remarkable for the scarcity of nimitti.

OSCINIDAE.

Oscinella aharonii was particularly abundant in parts of the Gezira.

CALLIPHORIDAE.

The larvae of *Chrysomyia putoria* which breed in vast numbers in pit latrines in some areas south of Khartoum can survive for over 24 hours in water. They were found to do this by swallowing air and holding it in the oesophageal diverticulum which acts as a floating organ.

MUSCIDAE.

Bird parasites—Passeromyia heterochaeta Villen., whose larvae attack young weaver birds, were found in nests examined by Mr. F. W. Blake at Wad Medani.

Musca. Public Health Officials at Omdurman considered that house-flies had become resistant to B.H.C., and specimens were collected for investigation at the time of the typhoid outbreak there. The resistance was confirmed and stocks were supplied to the London School of Tropical Medicine and the Hawthorndale Laboratory of the Imperial Chemical Industries Ltd. for detailed study of the mechanism involved. The use of pyrethrum powder was recommended as an emergency measure, but in future fly control will have to depend mainly on basic sanitary measures.

Studies at Wad Medani showed that the increase of *Musca* during the rains is very much delayed apparently owing to the rapid destruction of its breeding media by various beetles which disappear in the dry season.

Glossina. Further information was sent to Mr. W. H. Potts who is preparing the tsetse fly map of Africa, and a map of sleeping sickness distribution was prepared for the Interafrican Tsetse and Trypanosomiasis Bureau.

SCORPIONS.

The classification of African scorpions has been revised in recent years by Dr. Max Vachon of the Paris Museum d'Historie Naturelle. He has kindly agreed to examine representative specimens from the Sudan collection which have been sent to him. They include at lease one new species.

TICKS.

Mr. H. Hoogstraal, who is studying the ticks of the Sudan, paid a second visit, and more specimens were sent to him.

PUBLICATIONS.

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Lewis, D. J. (1953). *Simulium damnosum* and its relation to onchocerciasis in the Anglo-Egyptian Sudan. *Bull. ent· Res.* 45, 597-644.

Lewis, D. J. (1953). The *Stegomyia* mosquitoes of the Anglo-Egyptian Sudan. *Ann. trop. Med. Parasit*, 47, 51-61.

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CHAPTER X.

METEOROLOGY.

Table XXXIII shows the mean of the rainfall recorded in provincial meteorological stations.

Province	No. of Stations	Mean rainfall m.m.	Highest recorded m.m.	Lowest recorded m.m.
Bahr El Ghazal	3	1,063	1,113	1,033
Blue Nile	10	401	863	178
Darfur	4	564	827	316
Equatoria	10	1,140	1,483	745
Kassala	10	335	742	38
Khartoum	2	163	177	148
Kordofan	9	626	889	386
Northern	3	94	143	15
Upper Nile	6	913	1,245	750

TABLE I.

OUT-PATIENTS

NEW CASES BY DISEASES AND TOTAL ATTENDANCES

DISEASE	B.EL-GHAZAL	BLUE NILE	DARFUR	EQUATORIA	KASSALA	KHARTOUM	KORDOFAN	NORTHERN	UPPER NILE	TOTAL	
1. Cholera	—	—	—	—	—	—	—	—	—	—	1
2. Plague	—	—	—	—	—	—	—	—	—	—	2
3. Smallpox ...	2	—	3653	6	—	—	3	1	5	3,670	3
4. Typhus	—	—	—	—	—	—	—	—	—	—	4
5. Yellow Fever ...	—	—	—	—	—	—	—	—	—	—	5
6. T. B. Pulmonary	106	502	80	250	351	940	404	358	143	3,134	6
7. T. B. Non-Pulmonary ...	55	542	42	52	391	678	246	180	158	2,344	7
8. Pneumonia ...	941	7,126	2,020	2,381	2,046	3,810	5,344	2,417	1,471	27,556	8
9. Influenza ...	250	1,183	2,648	1,880	1,411	5,914	5,560	4,658	577	24,081	9
10. Other Respiratory diseases ...	14,654	161,630	57,226	81,779	74,536	102,524	101,443	59,620	25,174	678,586	10
11. Cerebrospinal Meningitis ...	1,055	432	504	12	89	22	613	66	145	2,938	11
12. Chickenpox ...	1,255	1,316	343	827	293	690	793	571	—	6,088	12
13. Diphtheria ...	4	116	17	14	19	437	60	38	12	717	13
14. Encephalitis Lethargica ...	—	—	—	—	—	20	—	—	—	20	14
15. Measles	1,001	3,041	1,291	108	840	2,632	2,742	1,629	101	13,385	15
16. Mumps	38	2,578	341	299	405	1,470	2,141	426	88	7,786	16
17. Poliomyelitis, acute	—	3	2	—	—	5	6	2	—	18	17
18. Rheumatism, acute	669	1,222	349	952	172	754	790	757	16	5,681	18
19. Whooping cough	49	2,399	341	379	171	685	1,692	971	204	6,891	19
20. Dysentery ...	1,447	16,722	7,406	996	4,271	8,437	8,878	5,006	3,055	56,218	20
21. Enteric Fever ...	2	158	3	13	34	233	4	90	61	598	21
22. Gastro-enteritis of children ...	461	14,407	654	120	1,147	15,887	2,179	3,465	2,286	40,606	22
23. Undulant Fever	—	12	1	14	8	28	5	1	6	75	23
24. Filariasis	22	91	20	388	1	2	2	—	13	539	24
25. Leishmaniasis ...	—	157	12	118	163	6	1	2	154	613	25
26. Malaria	6,116	89,074	29,210	32,717	28,891	16,326	79,907	22,065	14,252	318,558	26
27. Blackwater Fever	1	1	—	—	2	—	—	—	—	4	27
28. Onchocerciasis ...	34	—	—	—	—	43	—	—	—	77	28
29. Phlebotomus Fever	—	—	—	—	1	9	—	—	—	10	29
30. Relapsing Fever	—	—	92	—	—	—	5	—	—	97	30
31. Trypanosomiasis	1	—	—	68	—	—	—	—	—	69	31
32. Ancylostomiasis	1,690	285	82	6,389	23	20	110	378	32	9,009	32
33. Dracontiasis ...	563	127	8	2,640	70	29	638	31	267	4,373	33
34. Schistosomiasis ...	229	11,493	4,079	3,801	440	968	4,913	3,272	91	29,286	34
35. Gornorrhoea ...	1,677	7,321	5,462	2,623	2,836	4,515	5,992	951	2,352	33,729	35
36. Soft Sore ...	49	774	783	125	714	893	1,214	57	47	4,656	36
37. Syphilis	3,844	22,302	28,013	5,774	10,498	9,854	27,862	7,674	14,826	130,647	37
38. Yaws	7,274	—	2	13,608	—	2	297	—	4,867	26,050	38
39. Anthrax	—	—	3	—	2	—	5	—	25	35	39
40. Hydrophobia, human	1	4	1	2	3	—	9	—	—	20	40
41. Leprosy ...	44	30	19	508	21	21	52	13	18	726	41
42. Madura Disease	—	365	13	—	65	1,291	119	51	2	1,906	42
43. Tetanus ...	25	46	3	14	8	6	11	10	7	130	43
44. Heat Stroke syndrome ...	—	—	—	—	12	1	1	3	—	17	44
45. Confinements ...	178	488	72	256	104	735	619	208	58	2,718	45
46. Gynaecological	56	6,577	604	30	2,798	8,530	3,225	1,246	198	23,264	46
47. Diseases of Pregnancy and Parturition ...	—	74	20	79	14	953	1,399	10	10	2,559	47
48. Puerperal Fever	1	45	18	2	7	46	28	202	3	352	48
49. Wounds and Injuries ...	29,931	199,202	93,274	139,373	118,972	97,413	136,106	72,390	38,873	925,534	49
50. Tropical Ulcer ...	5,954	3,798	1,233	8,368	1,764	223	4,186	17	3,091	28,634	50
51. Diabetes ...	2	171	37	—	118	446	389	339	10	1,512	51
52. Pellagra	—	1	—	—	—	2	—	9	—	12	52
53. Scurvy	—	168	2	41	386	11	242	52	3	905	53
54. Neoplasms, malignant ...	6	267	51	48	52	79	119	41	39	702	54
55. Neoplasms, non-malignant ...	79	1,915	84	51	1,026	195	531	682	47	4,610	55
56. Trachoma ...	378	54,467	11,771	571	9,820	31,662	12,127	37,545	2,621	160,962	56
57. All other eye diseases ...	9,417	144,394	38,629	44,406	66,271	183,543	94,451	67,330	28,879	677,320	57
58. Ear diseases ...	3,269	36,858	13,098	7,788	15,099	13,719	27,027	16,059	5,775	138,692	58
59. Skin diseases ...	6,092	23,393	19,527	25,874	7,796	13,706	21,199	8,501	8,567	134,655	59
60. Alimentary diseases ...	13,256	202,474	73,958	82,794	103,016	105,371	131,433	102,675	28,086	843,063	60
61. Circulatory diseases ...	229	11,159	4,408	97	4,154	9,007	41,838	10,062	152	81,106	61
62. Genito-Urinary diseases ...	353	19,955	12,730	327	7,025	11,697	20,209	22,930	4,146	99,372	62
63. Organic Nervous diseases ...	—	5,276	447	7	169	1,289	3,574	3,630	122	14,514	63
64. Functional Nervous diseases	172	209	12	232	—	18	—	42	289	974	64
65. Fever of unertain origin	4,791	28,879	12,821	20,623	22,742	59,827	10,543	20,197	15,623	196,046	65
66. All other conditions ...	21,091	134,588	32,121	76,541	51,196	74,277	223,327	55,464	42,531	711,196	66
67. Poisoning... ...	—	27	18	—	8	37	56	59	30	235	67
68. Ascaries	—	—	—	183	—	—	—	—	—	183	68
69. Hydatid Disease	—	—	—	28	—	—	—	—	—	28	69
70. Dengue Fever ...	—	—	—	—	—	—	37	—	—	37	70
Total New Cases	138,814	1,218,957	459,658	566,534	542,459	791,938	987,706	534,453	249,608	5,490,127	
ATTENDANCES : MEN ...	355,073	1,024,867	442,743	763,796	622,441	1,051,910	830,919	447,357	277,005	5,816,111	
WOMEN ...	134,255	647,169	324,489	363,962	212,137	715,019	680,245	426,378	165,466	3,669,120	
CHILDREN ...	97,099	952,279	433,748	293,038	424,991	277,752	821,088	712,591	227,378	4,239,964	
Total Attendances ...	586,427	2,624,315	1,200,980	1,420,796	1,259,569	2,044,681	2,332,252	1,586,326	669,849	13,725,195	
MISSIONS	—	—	—	46,608	—	40,532	97,644	—	56,411	241,195	
Grand Total	586,427	2,624,315	1,200,980	1,467,404	1,259,569	2,085,213	2,429,896	1,586,326	726,260	13,966,390	

SUDAN : 1952/1953

ADMISSIONS AND DEATHS BY DISEASES

DISEASE	BAHR-EL-GHAZAL		BLUE NILE		DARFUR		EQUATORIA		KASSALA		KHARTOUM		KORDOFAN		NORTHERN		UPPER NILE		TOTAL		
	Cases	Deaths	Cases	Deaths	Cases	Deaths	Cases	Deaths	Cases	Deaths	Cases	Deaths	Cases	Deaths	Cases	Deaths	Cases	Deaths	Cases	Deaths	
1. Cholera	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1
2. Plague	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	2
3. Smallpox	2	—	—	—	3,653	578	6	—	—	—	—	—	1	—	1	—	5	—	3,668	578	3
4. Typhus	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	4
5. Yellow Fever	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	5
6. T.B. Pulmonary	100	23	298	31	62	4	149	21	276	33	403	39	179	17	192	7	91	7	1,750	182	6
7. T.B. Non-Pulmonary	61	1	151	13	18	—	37	7	136	5	96	1	104	4	94	1	63	2	760	34	7
8. Pneumonia	830	28	1,055	57	719	31	1,398	100	1,036	67	950	50	1,721	82	503	23	544	10	8,765	448	8
9. Influenza	26	—	12	—	114	9	275	4	110	—	118	—	58	2	40	—	43	—	796	15	9
10. Other Respiratory diseases	399	1	1,013	18	304	25	571	27	1,188	36	456	6	2,476	30	633	4	260	2	7,400	149	10
11. Cerebrospinal Meningitis	1,055	195	432	154	504	105	5	2	89	14	22	—	613	149	66	12	145	13	2,931	644	11
12. Chickenpox	942	—	182	1	132	1	465	—	141	—	109	—	292	—	38	—	100	—	2,391	2	12
13. Diphtheria	—	—	82	20	9	—	13	2	13	4	30	1	11	—	35	9	12	1	205	37	13
14. Encephalitis Lethargica	—	—	—	—	—	—	—	—	—	—	6	—	—	—	—	—	—	—	6	—	14
15. Measles	592	5	180	1	426	2	41	—	217	—	166	6	542	2	31	1	27	1	2,222	18	15
16. Mumps	89	—	48	—	130	—	79	—	128	—	15	—	285	—	8	—	3	—	785	—	16
17. Poliomyelitis, acute	—	—	1	—	1	—	—	—	—	—	—	—	2	—	2	—	—	—	6	—	17
18. Rheumatism, acute	205	—	76	—	27	—	61	2	47	—	26	—	58	—	104	—	13	—	617	2	18
19. Whooping cough	3	—	24	1	12	1	87	—	6	—	15	1	226	2	21	—	22	2	416	7	19
20. Dysentery	542	19	507	12	663	13	441	16	471	11	445	21	456	12	157	1	333	10	4,015	115	20
21. Enteric Fever	1	—	158	9	3	2	13	—	33	2	233	42	3	—	90	5	61	3	595	63	21
22. Gastro-enteritis of children	167	—	224	19	19	2	114	6	99	22	277	44	172	18	110	9	200	10	1,382	130	22
23. Undulant Fever	—	—	15	1	1	—	6	—	8	—	7	—	5	—	1	—	6	—	49	1	23
24. Filariasis	21	—	2	—	11	—	102	—	—	—	1	—	4	—	—	—	—	—	141	—	24
25. Leishmaniasis	—	—	157	8	8	—	117	9	163	20	6	—	1	—	2	—	149	16	603	53	25
26. Malaria	2,108	20	2,651	58	1,034	8	4,151	129	2,326	27	775	7	3,784	55	719	3	760	11	18,308	318	26
27. Blackwater Fever	1	1	1	1	—	—	2	1	—	—	—	—	—	—	—	—	—	—	4	3	27
28. Onchoccroiasis	31	—	—	—	—	—	—	—	—	—	18	—	—	—	—	—	—	—	49	—	28
29. Phlebotomus Fever	—	—	—	—	—	—	—	—	—	—	2	—	—	—	—	—	10	—	12	—	29
30. Relapsing Fever	—	—	—	—	92	12	—	—	—	—	—	—	5	2	—	—	—	—	97	14	30
31. Trypanosomiasis	1	—	—	—	—	—	68	1	—	—	—	—	—	—	—	—	—	—	69	1	31
32. Ancylostomiasis	1,043	13	5	—	55	1	3,135	14	13	1	12	—	—	—	42	—	6	—	4,311	29	32
33. Dracontiasis	195	—	31	—	4	—	283	—	33	—	13	—	100	—	5	—	22	—	686	—	33
34. Schistosomiasis	101	1	414	5	22	—	2,066	9	26	—	62	—	96	1	481	1	26	—	3,294	17	34
35. Gonorrhoea	1,309	—	272	—	331	3	1,009	—	357	—	36	—	564	1	162	—	166	2	4,206	6	35
36. Soft Sore	2	—	14	—	31	—	11	—	45	—	37	—	20	—	4	—	29	—	193	—	36
37. Syphilis	731	5	374	3	2,069	6	1,636	—	351	4	92	1	293	23	170	—	1,096	2	6,812	44	37
38. Yaws	312	2	—	—	2	—	929	3	—	—	—	—	—	—	—	—	621	4	1,864	9	38
39. Anthrax	—	—	3	—	4	—	—	—	2	—	—	—	1	—	—	—	—	—	10	—	39
40. Hydrophobia, human	1	1	1	1	1	1	2	2	3	3	—	—	9	9	—	—	—	—	17	17	40
41. Leprosy	33	1	4	—	17	2	83	—	1	—	21	—	10	1	5	—	17	—	191	4	41
42. Madura Disease	—	—	154	—	5	—	—	—	39	—	66	—	36	—	34	—	2	—	336	—	42
43. Tetanus	22	12	55	5	3	1	14	5	5	4	6	2	9	4	11	2	4	1	129	36	43
44. Heat Stroke Syndrome	—	—	—	—	—	—	—	—	12	—	1	—	1	—	3	1	—	—	17	1	44
45. Confinements	178	6	516	7	63	3	248	5	106	7	281	7	310	24	156	17	47	1	1,905	77	45
46. Gynaecological	44	—	1,373	5	124	2	28	2	440	4	655	12	689	4	493	5	42	—	2,610	30	46
47. Diseases of Pregnancy and Parturition	—	—	95	1	20	2	79	—	13	—	511	3	26	1	10	—	3	—	699	9	47
48. Puerperal Fever	1	1	37	3	4	—	2	—	7	2	72	4	10	1	24	—	—	—	120	8	48
49. Wounds and Injuries	2,433	45	3,927	75	2,754	41	3,906	64	2,781	39	2,249	18	3,835	58	1,323	23	1,503	17	24,711	380	49
50. Tropical Ulcer	645	5	74	—	242	1	771	10	103	1	131	—	540	—	—	—	713	7	3,219	24	50
51. Diabetes	2	—	57	4	5	1	—	—	45	1	84	1	29	3	81	2	—	—	303	12	51
52. Pellagra	—	—	2	—	—	—	—	—	—	—	3	—	1	—	5	1	—	—	11	1	52
53. Scurvy	—	—	9	—	1	1	4	—	13	—	8	—	8	1	2	—	14	—	59	2	53
54. Neoplasms, malignant	3	—	40	4	29	3	30	4	25	2	72	5	35	2	29	2	39	12	302	34	54
55. Neoplasms, non-malignant	54	—	73	3	27	—	69	4	54	1	51	—	50	1	25	—	47	3	450	12	55
56. Trachoma	16	—	42	—	57	—	13	—	3	—	44	—	64	—	121	—	77	—	437	—	56
57. All other eye diseases	237	—	197	—	175	—	804	—	285	—	708	—	262	—	298	1	1,199	—	4,165	1	57
58. Ear diseases	74	—	46	—	49	—	238	—	57	—	22	—	71	—	31	—	49	—	637	—	58
59. Skin diseases	357	2	220	2	122	2	750	1	93	—	99	1	256	—	100	—	196	—	2,193	8	59
60. Alimentary diseases	782	25	1,601	66	386	8	2,429	35	1,533	89	2,481	45	1,639	60	1,164	37	552	16	12,567	381	60
61. Circulatory diseases	62	13	410	40	184	8	38	1	326	38	475	34	342	50	581	36	13	1	2,431	221	61
62. Genito-Urinary diseases	93	1	616	14	264	14	81	—	396	8	428	3	608	43	498	13	51	2	3,035	98	62
63. Organic Nervous diseases	—	—	66	2	41	1	5	—	76	7	94	2	104	11	87	9	21	1	494	33	63
64. Functional Nervous diseases	26	1	7	1	2	—	22	1	—	—	47	—	—	—	40	—	98	13	242	16	64
65. Fever of uncertain origin	115	3	349	22	237	6	70	9	844	25	623	16	299	21	586	14	1,888	21	5,011	137	65
66. All other conditions	4,306	76	1,222	42	436	7	3,094	58	1,123	28	836	32	1,186	32	788	12	—	—	13,848	156	66
67. Poisoning	—	—	26	2	39	6	—	—	4	1	9	—	18	1	20	3	—	—	116	13	67
68. Ascaris	—	—	—	—	—	—	183	—	—	—	—	—	—	—	—	—	—	—	183	—	68
69. Hydatid Disease	—	—	—	—	—	—	28	5	—	—	—	—	—	—	—	—	—	—	28	5	69
70. Dengue Fever	—	—	—	—	—	—	—	—	—	—	—	—	7	—	—	—	—	—	7	—	70
Total	20,353	506	19,601	711	15,747	913	30,261	559	15,701	506	14,515	268	22,525	727	10,226	254	11,388	191	159,801	4,635	
MISSIONS	—	—	—	—	—	—	1,287	13	—	—	1,478	136	1,765	31	—	—	—	—	4,530	180	
Grand Total	20,353	506	19,601	711	15,747	913	31,548	572	15,701	506	15,993	404	24,290	758	10,226	254	11,388	191	164,331	4,815	